Utah State Water Plan

UINTAH BASIN

Division of Water Resources

December, 1999

STATE OF UTAH
NATURAL RESOURCES
Division of Water Resources

Utah State Water Plan

Uintah Basin

Utah Board of Water Resources
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Utah Division of Water Resources
Utah Department of Natural Resources

Utah State Water Plan - Uintah Basin

Section 1

Uintah Basin Plan

Foreword

Distributed in early 1990, the *State Water Plan* established the foundation for state water planning. Building upon that, more detailed plans are being prepared for each of the state's 11 hydrologic basins. The *Uintah Basin Plan* is one of these. To clarify the descriptions of location and geography, the Uintah Basin includes the hydrologic Uinta Basin plus the north slope of the Uinta Mountains. It has been divided into five planning areas. These include the Upper Green, Ashley-Brush, Duchesne/ Strawberry, Green and White areas.

This plan covers all aspects of the basin's water resources. It identifies alternative ways to solve problems and meet demands. Final decisions on selecting alternatives for implementation will rest with local decision-makers.

The *Uintah Basin Plan* will disseminate valuable water-related public information; encourage community and economic growth; provide opportunity for local, state and federal cooperation; identify water supplies and needs; and promote local involvement in water planning. This basin plan will also help achieve the Department of Natural Resources' mission to conserve, protect and develop Utah's natural resources.

Acknowledgment

The Board of Water Resources gratefully acknowledges the dedicated efforts of the State Water Plan Steering Committee and Coordinating Committee in preparing the *Uintah Basin Plan.* This work was spearheaded by the planning staff in the Division of Water Resources, with valuable assistance from individual coordinating committee members and their associates representing state agencies with water-related missions. Their high standards of professionalism and dedication for improving Utah's natural resources were essential.

We appreciate the input and assistance of representatives of state and federal cooperating entities and members of the basin planning advisory group who expressed opinions and provided expertise from a broad spectrum of Utah's population. Representatives of many local entities and groups provided much needed assistance at the grass-roots level.

We extend thanks to those who attended meetings and provided written and oral comments. In endorsing this plan, we reserve the right to consider local water projects on their own merits.

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Section 2
Uintah Basin Plan

Executive Summary

This section summarizes the *Uintah Basin Plan*. Like the *State Water Plan*, the *Uintah Basin Plan* contains 19 sections. It also has Section A, Acronyms, Abbreviations and Definitions, and Section B, Bibliography. Headings used in the Executive Summary coincide with those used in the body of this plan and the *State Water Plan*.

2.1 Foreword

The *State Water Plan* (1990) provides the foundation and general direction for managing waters of the state. Detailed plans for the Bear River, Kanab Creek/Virgin River, Cedar/Beaver, Weber River, Jordan River, Utah Lake and Sevier River basins are completed. This plan is number eight. The remainder of the 11 basin plans are nearing publication.

The purpose of this plan is to identify potential conservation and development projects and describe alternatives to satisfy the problems, needs and demands. It will also disseminate valuable water-related public information; encourage community and economic growth; provide opportunity for local, state and federal cooperation; identify water supplies and needs, and promote local involvement in water planning.

2.3 Introduction

Section 3 contains general guidelines used to ensure continuity during plan preparation. It explains the organizational structure and process for reviews and for making comments at various stages. It also describes the settlement, history, climate, physical characteristics and land ownership in the basin.

The Uintah Basin is divided into two drainages; the north slope and the south slope of the Uinta Mountains. The north slope is bounded by the Uinta Mountains to the south, the Wyoming border to the north, the Colorado border to the east, and the Bear River drainage to the west. The south slope is bounded by the Uinta Mountains to the north, the Tavaputs Plateau and the Book Cliffs to the south, Diamond Mountain and the Utah/Colorado border to the east, and the Wasatch Range to the west.

Brown Duck Basin

This basin covers 6,969,600 acres, of which 73 percent is administered by the federal government and the Bureau of Indian Affairs. State government administers 8 percent and 19 percent is private land.

The annual precipitation ranges from 7.1 inches at Roosevelt to 12.5 inches at Flaming Gorge Reservoir. The monthly maximum mean temperature reaches 94.6 degrees in July and a minimum mean 2.5 degrees in January. Elevations range from 13,528 feet at Kings Peak in the Uinta Mountains to 4,150 feet where the Green River exits the basin just above the Price River.

Water development in this basin dates back to the early Mormon pioneers and the American Indians. The Uintah and Ouray Indian Reservation was established in 1861. In 1905 the U. S. Government opened the lands not allotted to the Indians for homesteading and white settlers began making their way into the basin. A short history of local communities' land and water development is presented in Section 3.

2.4 Demographics and Economic Future

This section discusses the basin's population, employment and economic future. Through the years the basin has been plagued by boom and bust relating to oil and oil shale. In spite of these cycles, the basin's population is expected to grow from an estimated 35,546 in 1990 to 87,020 in 2050. Vernal is the largest city with a 1998 population of 7,111.

Uintah Basin employment is projected to increase from 17,823 jobs in 1995 to 28,025 in 2020. Long-term outlook for the economy of the basin is positive, and growth will be in minerals and tourism.

2.5 Water Supply and Use

Section 5 discusses the historical water supplies and present uses. Most of the water used in the basin is for agricultural, municipal and industrial purposes and comes from numerous streams originating in the Uinta Mountains. This water is diverted directly from streams or stored in numerous reservoirs. The primary hydrologic feature of the basin is the Green River which collects flow from the north and south slopes of the Uinta Mountains. Presently developed water supplies in the basin total 811,380 acre-feet. Agricultural irrigation diverts 797,610 acre-feet annually, municipal and industrial 21,430 acre-feet, and 2,500 acre-feet is diverted for secondary water use. Potential average annual diversions to the Wasatch Front are: Strawberry Collection System, 101,900 acre-feet; Strawberry Water Users, 61,500 acre-feet; and Duchesne Tunnel, 31,700 acre-feet. The total of all these diversions is greater than the developed supply because water, primarily agricultural water, is rediverted and reused as it moves through the river system. Depletions are: agricultural irrigation, 411,310 acre-feet; municipal and industrial, 6,870 acre-feet; and potential Wasatch Front exports, 195,100 acre-feet. Groundwater supplies are used for municipal, industrial and agricultural purposes. An estimated 35,000 acre-feet of groundwater recharge occurs on the south slope of the Uinta Mountains, and 91,000 acre-feet occurs on the north slope.

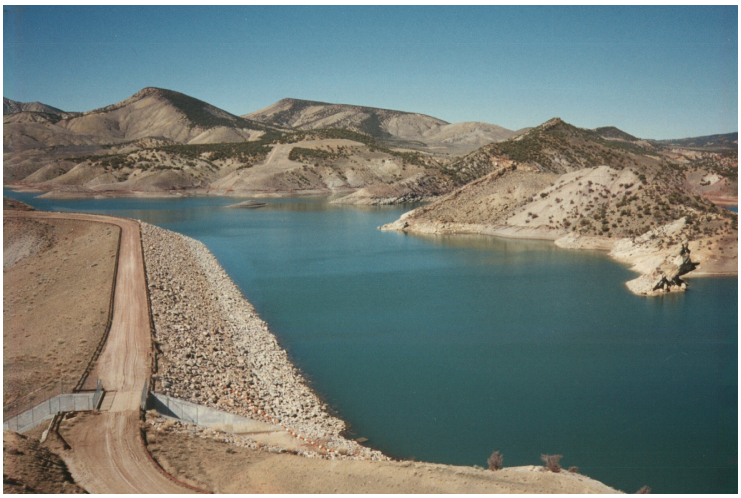
2.6 Management

This section describes the water management functions of private and government entities. The Central Utah Water Conservancy District and the Uintah Water Conservancy District are the primary water wholesalers in the Uintah Basin. The basin has 47 major irrigation companies and 28 public community providers.

The Uintah Basin has 82 active reservoirs and lakes used for water storage. Thirty-eight are below 1,000 acre-feet in storage. With completion of the Central Utah Project, many of the large dam and reservoir sites will be developed. Future growth may result in smaller dam sites being considered for construction on tributaries and the diversion of Green River water for use in the basin.

Water management enables the delivery of water to people and places at the optimum time and condition. One of the present challenges facing water managers in the Uintah Basin is delivering water for irrigation during dry years or in areas where no reservoir storage is available for spring runoff impoundment for late summer delivery to water users.

Following the current large water project development period, long-range planning will become more crucial. Public involvement and collaboration among competing water interests will be required. There is a growing need for education programs to prepare present and future leaders to make informed choices about how water is managed. Trade-offs between economic and environmental values can best be made by people who understand the nature of water and the role it plays in natural ecosystems and in economic growth.



Red Fleet Reservoir

2.7 Regulation/Institutional Considerations

This section discusses the agencies responsible for water regulation in the Uintah Basin. This includes consideration of water rights, water quality and environmental concerns.

The Division of Water Rights, under the direction of the State Engineer, regulates water allocation and distribution and oversees dam safety. Water quality is regulated at the state level by the Department of Environmental Quality through two agencies, the Division of Water Quality and the Division of Drinking Water. Other agencies and organizations that regulate water in the basin are water conservancy districts, special service districts, city water departments, mutual irrigation companies and private water companies. Standards are also set for monitoring frequency and procedures.[6]

Dam safety is a concern. Twenty-five high hazard dams exist in the basin. The high hazard rating does not mean a dam is unstable or in poor repair, but means that if it were to fail there would be loss of life or significant property damage.

Reservoirs in the Uintah Basin attract large crowds of flat-water recreationists. Pollution of the drinking water flowing from these reservoirs is an increasing problem. Overcrowding and associated safety issues, especially at Strawberry and Steinaker reservoirs, are also concerns.

Inclusion of the Colorado pikeminnow (formerly Colorado squawfish), humpback chub, bonytail chub and razorback sucker on the endangered species list by the U. S. Fish and Wildlife Service (USFWS) has necessitated close coordination with USFWS and other resource agencies for those who wish to alter and diversify the uses of the Green River and its tributary waters. Releases of high flows to simulate spring runoff from Flaming Gorge Dam has impacted the present excellent trout fishery and fishing industry below the dam. Flooding in the Jensen area has occurred and caused damage to farmland and road systems. Also, some of the dikes (ponds) at Browns Park State Waterfowl Management Area and Ouray National Waterfowl Refuge have been damaged.

Drains installed in the Jensen area by the Bureau of Reclamation to take irrigation return flows to Stewart Lake have created a selenium problem with the wildlife. The drains have been diverted around the lake and now discharge directly into the Green River.

The Mosby Canal was breached in 1997 and joined with water from spring runoff to form an erosion gully 200 feet deep, about 400 feet across and 2,000 feet long. Nearly 1.5 million cubic yards of fine red soil washed into Dry Fork Creek, an important source of irrigation and culinary water for Ashley Valley.

Problems from the sediment closed down the Ashley Valley Water Treatment Plant, filled canals and plugged sprinkler systems. Future erosion and sediment deposition in Dry Fork and Ashley creeks still exist. The Ashley Creek Stabilization Project is being designed to solve these problems.

Adequate environmental water considerations are providing quantity and quality of water to maintain crucial wildlife habitats and populations. Providing instream flow as a beneficial use to maintain fish and wildlife populations, riparian vegetation, and stream channels is widely recognized as important. Wetlands are important for groundwater recharge and discharge, flood storage, shoreline stabilization, sediment trapping, water purification, pollution control, food chain support, and fish and wildlife habitat establishment.

The Uintah Basin has several environmentally sensitive areas. These include the lower 2-1/2 miles of the Duchesne River (which has been designated as critical habitat for the razorback sucker by the U. S. Fish and Wildlife Service), Stewart Lake, Nine Mile Canyon, the Book Cliffs and the High Uinta Wilderness.

2.8 Water Funding Programs

Federal, state and private funding programs are described in Section 8. Funding programs are available to provide loans and grants for many types of water-related projects. The Central Utah Project has spent about $1.2 billion on water projects by the Bureau of Reclamation. Agencies of state government have provided almost $31 million to water system development and improvements. The federally funded Colorado River Salinity Control Program has contributed over $41 million.

2.9 Water Planning and Development

This section describes the major past, present, and proposed water planning and development activities in the Uintah Basin, including a discussion of the Central Utah Project. The current water planning and development in Duchesne and Uintah counties includes determining the projects that will be included in the final phase of the Central Utah Project. The Colorado River Salinity Control Program, a federal, state and local cooperative program ongoing in the Uintah Basin, is discussed.

A list of the water projects receiving financial assistance from the Board and Division of Water Resources is provided in this section. Proposed local water projects such as Red Wash Dam, Lower Ashley Creek Dam, Leota Bench Supplemental Irrigation, Ashley Creek Stabilization, Alta Ditch, Highline, Upper Canal, Red Creek Irrigation, Dry Gulch Class C, Pleasant Valley and Payne Canal are discussed.

Projected demand for irrigation water will decrease from 797,610 acre-feet in 1995 to 781,920 acre-feet in 2050. Municipal and industrial water will increase from 12,110 acre-feet in 1995 to 26,940 acre-feet in 2050. Projects to increase water supplies in the basin are more efficient irrigation methods, conservation and small reservoir construction.

An issue of concern to water suppliers is that many communities are not adequately planning for future growth. All communities should prepare a long-term water management plan which includes new water supply sources and water conservation programs.

2.10 Agricultural Water

This section discusses the agricultural aspects of the basin. Agricultural activities are an important part of the economy. There are 201,120 acres of irrigated cropland which deplete about 411,310 acre-feet of water annually (mostly for pasture and alfalfa).

Present cropland trends show a decrease to 197,490 acres by 2050. Crop yields have decreased in areas with poor drainage and salt toxicity problems. The Colorado River Salinity Project, however, has helped to increase crop yields through better irrigation practices, such as sprinkler and gated pipe irrigation.

Two water policy issues affecting agriculture are a general shortage of irrigation water during July and August, due to inadequate reservoir storage in the basin, and the reduction of the Colorado River Salinity Control Program. Water storage reservoirs should be constructed on the Yellowstone, Uinta, and Whiterocks rivers and upper and lower Ashley Creek. The Colorado River Salinity Control Program in the Uintah Basin should be fully funded and completed.

2.11 Drinking Water

Section 11 discusses public and private water supplies in the basin and reviews their present status. Towns, cities and counties all have primary responsibility for drinking water quality control in their jurisdiction, under rules set forth by the state. All of the 28 public drinking water systems in the basin have been approved by the Utah Division of Drinking Water.

Most public community culinary water supplies will be adequate into 2050. Verification that a public water system is meeting state and federal

quality standards is made through monitoring programs established by regulations. Rules for Public Drinking Water Systems (RPDWS) outline procedures for local treatment plant operators to follow and the state's responsibilities in water quality testing. The Utah Safe Drinking Water Act and the Federal Safe Drinking Water Act, with all amendments, are discussed as are drinking water problems associated with facility operations and groundwater contamination.

Per capita water use ranges from 223 gallons per capita per day (gpcd) in Duchesne County to 366 gpcd in Daggett County and 240 gpcd in Uintah County. Water use in Daggett County is high due to tourists visiting Flaming Gorge Reservoir.

Drinking water issues revolve around water quality and the protection from contamination by untreated wastewater and treated wastewater effluent, and by poor land use practices involving streams, reservoirs and groundwater aquifers.

Mountain meadow, north slope of Uintas

2.12 Water Quality

Section 12 presents data and information on existing levels of water quality throughout the Uintah Basin. Sources of pollution are identified, problems and solutions are discussed, and a recommendation is given for control and improvement by responsible agencies.

Most of the water in the basin is of good quality. The quality of some surface water streams carries high sediment loads during periods of high spring snowmelt runoff and when high intensity summer storms occur.

An assessment of water quality beneficial use support was made on 2,834 miles (80 percent) of the total stream miles. Of these, 2,208 miles were assessed as fully supporting all of their beneficial uses, 240 miles were assessed as partially supporting, and 386 miles were assessed as non-supporting at least one beneficial use.

Most groundwater pollution is from natural geologic sources such as the Green River and Wasatch formations. Excess selenium and alkali have been monitored in Stewart Lake Waterfowl Management Area, Lower Ashley Creek, Ouray National Wildlife Refuge and Pariette Wetlands.

The NRCS Uinta Basin Salinity Control Project (which includes the Duchesne and Ashley Valley drainages) projects a reduction of 52,400 acre-feet of return flow from on-farm irrigation, deep percolation and off-farm lateral seepage loss. It also projects a total of 111,210 tons of salt load reduction annually to the Colorado River.

Issues impacting water quality in the Uintah Basin are an increase in salt-loading from irrigated agriculture, water and land contamination due to oil/gas well drilling, and elevated levels of total phosphorus and dissolved solids in several basin streams. The federal government should increase funding to the on-farm (USDA) and off-farm Bureau of Reclamation salinity programs to achieve goals in salinity reduction. Also, the Bureau of Land Management, Forest Service and the Utah Division of Water Quality should increase water quality monitoring in selected drainages for any presence of effluent from oil and gas development projects. The Utah Division of Water Quality, Division of Wildlife Resources, U. S. Fish and Wildlife Services, Bureau of Land Management, Forest Service and others should also cooperate in future data-gathering and analysis.

2.13 Disaster and Emergency Response

Section 13 discusses flood hazard mitigation and drought response. It also briefly discusses programs presently in place and additional programs that could be beneficial in dealing with flooding and drought problems. Many types of emergency situations are water-related, including disastrous flooding from earthquakes, landslides and extreme drought. Planning efforts focus on measures that may lessen or eliminate the impact of future disasters. Drought damage can be reduced by precipitation augmentation, water conservation, increasing carry-over storage in reservoirs during non-drought years and drought planning.

The National Flood Insurance Program (NFIP) makes flood insurance available to municipalities as a protection against monetary losses when flooding occurs. Damages for the 1983-1984 ($10.1 million) and 1997 floods ($6.4 million) are shown in this section.

Issues impacting disaster and emergency response are that some local governments do not have plans for managing flood plains, and they lack hazard mitigation plans, disaster response plans, and emergency operation plans. Participating NFIP communities should review their flood damage prevention ordinances to insure they are meeting the minimum requirements for participation in the National Flood Insurance Program.

2.14 Fisheries and Other Water-Related Wildlife

Section 14 describes the fisheries and other water-related wildlife currently found in the basin. The Division of Wildlife Resources has responsibility for managing, protecting, propagating and conserving the state's wildlife. The Fish and Wildlife Service has authority to conserve and protect endangered and threatened species on federal and private lands. Responsibilities of the Central Utah Water Conservancy District to augment water supplies and support fish and wildlife interests are briefly explained. Minimum instream flows, watershed protection, stream bank erosion and wetlands protection are the greatest needs for wildlife.

A state wetland protection plan is currently being prepared by the Governor's Office. High priority wetland areas will be identified, and opportunities for protection and enhancement will be addressed. Big game winter rangeland will be purchased under Section 305 of the Utah Reclamation Mitigation and Conservation Commission. Big game crossings and wildlife escape ramps in large canals are also to be provided.

2.15 Water-Related Recreation

Section 15 describes how water relates to recreation. Water is part of almost all recreation provided in the Uintah Basin, from water skiing to camping, to pools in municipal recreation centers, to flat water boating on major reservoirs. Design of water access and recreation features associated with water development projects are important components of water planning and development.

Lists of recreation facilities and campgrounds maintained by the Bureau of Land Management, Dinosaur National Monument, Flaming Gorge National Recreation Area, National Forest Service and state parks are listed for the Uintah Basin. The basin contains five state parks with a total of 308,340 visitations for 1997, including the Natural History Field House in Vernal and four reservoirs.

Issues that impact water-related recreation are unethical behavior in recreational settings and comprehensive planning for allocation of resources. The Division of Parks and Recreation, in cooperation with other recreation agencies, should organize focus groups with recreationists and managers from throughout the state to obtain ideas and support from all members of the recreation community. People who create the conflicts should be represented and encouraged to participate. Also, the Division of Parks and Recreation should continue to implement findings of the Uintah and Diamond Mountain Resource Management plans and the *Flaming Gorge National Recreation Area Management Plan* to balance use and resource capacity to achieve sustainability of water resource uses for recreation.

2.16 Federal Water Planning and Development

Section 16 gives a brief description of various agency programs. Although the activities of federal agencies are changing, many historical programs are still available. To use them, local people must be informed about program functions and how to gain access. With this information, better interagency and local working relationships are possible.

The impact of threatened and endangered species must be considered and planned for in all water planning and development projects. A list of candidates and listed endangered species is presented. Some of the endangered species are razorback sucker, bonytail chub, Colorado pike-minnow (formerly Colorado squawfish), whooping crane, humpback chub, black-footed ferret, barneby ridge-cress, shrubby reed-mustard and the southwestern willow flycatcher.

2.17 Water Conservation

This section discusses conservation ideas and their significance to water planning. The need for water pricing measures to provide stable revenues for water users to improve efficiency is also addressed as an important part of any conservation program.

Water sources presently being developed are expensive. New sources will be even more costly. The time to think about and teach conservation has come. Fortunately, water development in the basin has kept ahead of water needs in modern times.

During the next generation (25-30 years), developed supplies in some systems will become fully used, and scarcity will return to some parts of the basin unless new supplies are developed.

Conversion of some irrigation water to municipal and industrial uses will likely occur. Increasing the efficiency of farm irrigation practices should continue.

Water quality is important in setting up a conservation program. If the goal is to conserve high quality water for meeting culinary growth demand, then providing a separate irrigation pipe network to utilize non-potable water for lawn and garden irrigation may be a logical solution.

Issues impacting water conservation are the need for communities to have plans for future growth, secondary water systems, water-conserving landscapes, and effective water rate schedules. Every community should develop water management and conservation plans and study the feasibility of constructing secondary water systems. Local communities should also study water-conserving landscapes and adopt water rate schedules that encourage water conservation.

2.18 Industrial Water

Section 18 discusses the present and future uses of water for industrial purposes in the Uintah Basin. For this report, industrial water use is defined as water used in mining and manufacturing operations including the production of oil, gas, chemicals, fertilizer or other products. It includes power production, processing, washing, mineral slurrying, oil well water-flooding and cooling operations, as well as employee use. Also included, to the extent they can be identified, are such activities as gravel-washing and ready mix concrete production.

Present industrial water use for the Uintah Basin is about 11,830 acre-feet. Hydroelectric and coal-fired power plants have a total capacity of 150,400 kw, with Flaming Gorge producing 145,850 kw.

2.19 Groundwater

Groundwater in the Uintah Basin has been developed for use as public water supplies, irrigation water and stock-watering. Springs were the first method developed to access underground water, followed by wells.

Section 19 describes groundwater conditions in the Uintah Basin. The boundaries of an aquifer are physical, thus they may outcrop, i.e., be offset by faulting against an impermeable rock unit. Aquifers may grade laterally into a lower permeability deposit due to changes in the depositional environment, or they may thin and disappear. At any given location, the land surface may be underlain by several aquifers. Each aquifer may have different chemical quality and different hydraulic potential. Each aquifer may be recharged in a different location and may flow in a different direction. Groundwater

divides do not necessarily coincide with surface water divides. These unique conditions demonstrate that the development and management of groundwater is more complicated than surface water.

Groundwater in the Uintah Basin ranges from fresh (less than 500 milligrams per liter of dissolved solids) to briny (more than 35,000 milligrams per liter of dissolved solids). Well and spring locations are shown in the report. The average annual discharge from wells and springs for domestic and industrial use is 21,060 acre-feet. ❑

Contents

Section 3
Uintah Basin Plan

Introduction

The *Uintah Basin Plan* covers all aspects of the basin's water resources and provides data for planning, conserving and developing water resources.

3.1 Background

This section presents planning principles and purposes and describes the organization and process for plan preparation. The physical aspects of the Uintah Basin are presented to provide a foundation for describing the water and water-related resources. Current statewide water planning was initiated in 1986 and resulted in the *State Water Plan* in January 1990.[154]

3.2 Planning Guidelines

The *State Water Plan* describes the basic premises and lays the foundation for state water planning. This insures continuity so individual basin plans will be consistent with the statewide plan and with each other.

3.2.1 Principles

The principles, values, uses and interests considered when preparing a basin plan are:

- All waters, whether surface or subsurface, are held in trust by the state as public property, and their use is subject to rights administered by the State Engineer.
- Water is essential to life. It is our responsibility to maintain or improve water quality to meet the needs of generations to follow.
- The diverse present and future interests of Utah's residents should be protected through a balance of economic, social, aesthetic and ecological values.
- Water uses for which it is difficult to identify beneficiaries, such as recreation and aesthetics, should be included in program evaluation.
- Public participation is vital to water resources planning.
- All state residents are encouraged to practice water conservation and implement wise water use practices.
- Water rights owners are entitled to transfer their rights under free market conditions.
- Water resources projects should be technically, economically and environmentally sound.
- Water planning and management activities of local, state and federal agencies should be coordinated.
- Local governments, with appropriate state assistance, are responsible for protecting against emergency events such as floods and droughts.
- Designated water uses and quality should be improved or maintained unless there is evidence the loss is outweighed by other benefits.
- Educating Utahns about water and the state water rights system is essential. Effective planning and management require a broad-based citizen understanding of water's physical characteristics, potential uses and value.

3.2.2 Purpose

This basin plan will assist local, state, and federal agencies to coordinate water-related activities while providing a process to help local water entities prepare long-term water conservation and management plans. It includes current basic information to help in setting priorities. It addresses policy issues and, where appropriate, makes specific recommendations to resolve them. The *Uintah Basin Plan* will help accomplish the mission of the Division of Water Resources to promote the orderly and timely planning, conservation, development, utilization and protection of Utah's water resources to enhance the quality of life for the citizens of the state.

3.2.3 Organization

The Division of Water Resources carries out state water planning under direction of the Board of Water Resources. A state water plan coordinating committee, composed of state agencies with water-related missions, assisted in preparation of this plan. A steering committee consisting of the chair and vice-chair of the Board of Water Resources, the executive director of the Department of Natural Resources, and the director and assistant director of the Division of Water Resources provides policy, resolves issues and approves plans before acceptance by the board. A local board member is invited to participate with the steering committee. In addition, other state and federal agencies which have expertise in various fields participate as cooperating agencies.

A local basin planning advisory group provides advice, review and decision-making. The group represents various local water interests and geographical areas within the basin.

Split Canyon, Green River

3.2.4 Process

Four drafts of the *Uintah Basin Plan* were prepared for review and approval. They include: 1) in-house, 2) committee, 3) advisory, and 4) public review drafts. After the process is complete, the final basin plan is distributed to the public.

3.3 Basin Description

The Uintah Basin Planning Area, located in northeastern Utah, is shown in Figure 3-1. It includes all of Daggett, Duchesne and Uintah counties and parts of Carbon, Emery, Grand, Summit, Utah and Wasatch counties. The principal drainage is the Green River, with the Duchesne and White rivers as major tributaries. The planning area covers 10,890 square miles (6,969,600 acres) and is divided into five sub-units: Upper Green, Ashley/Brush, Duchesne/ Strawberry, and the Green and White areas (shown in Figure 3-2). Vernal, Roosevelt, Duchesne and Manila are the largest commercial centers in the planning area.

3.3.1 Drainage Area and Topography

The Uintah Basin is divided into two drainages -- the north slope and the south slope of the Uinta Mountains. The north slope is bounded by the Uinta Mountains to the south, the Wyoming border to the north, the Colorado border to the east, and the Bear River Basin to the west. The south slope is bounded by the Uinta Mountains to the north, the Tavaputs Plateau and the Book Cliffs to the south, Diamond Mountain and the Utah/ Colorado border to the east, and the Wasatch Range to the west. Elevations range from 13,528 feet at Kings Peak in the Uinta Mountains to 4,150 feet where the Green River exits the basin, just above its confluence with the Price River.

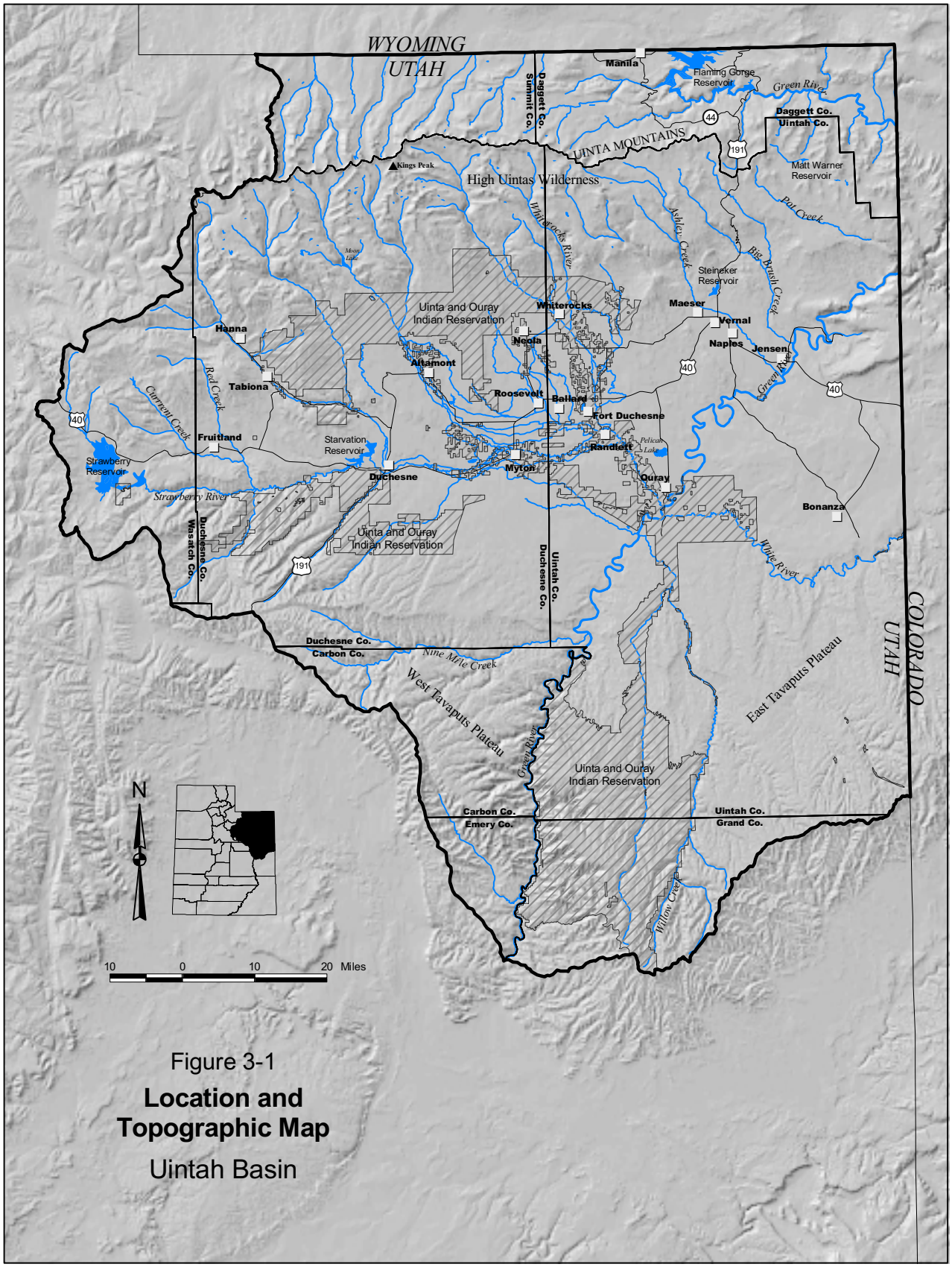


Figure 3-1

Location and Topographic Map

Uintah Basin

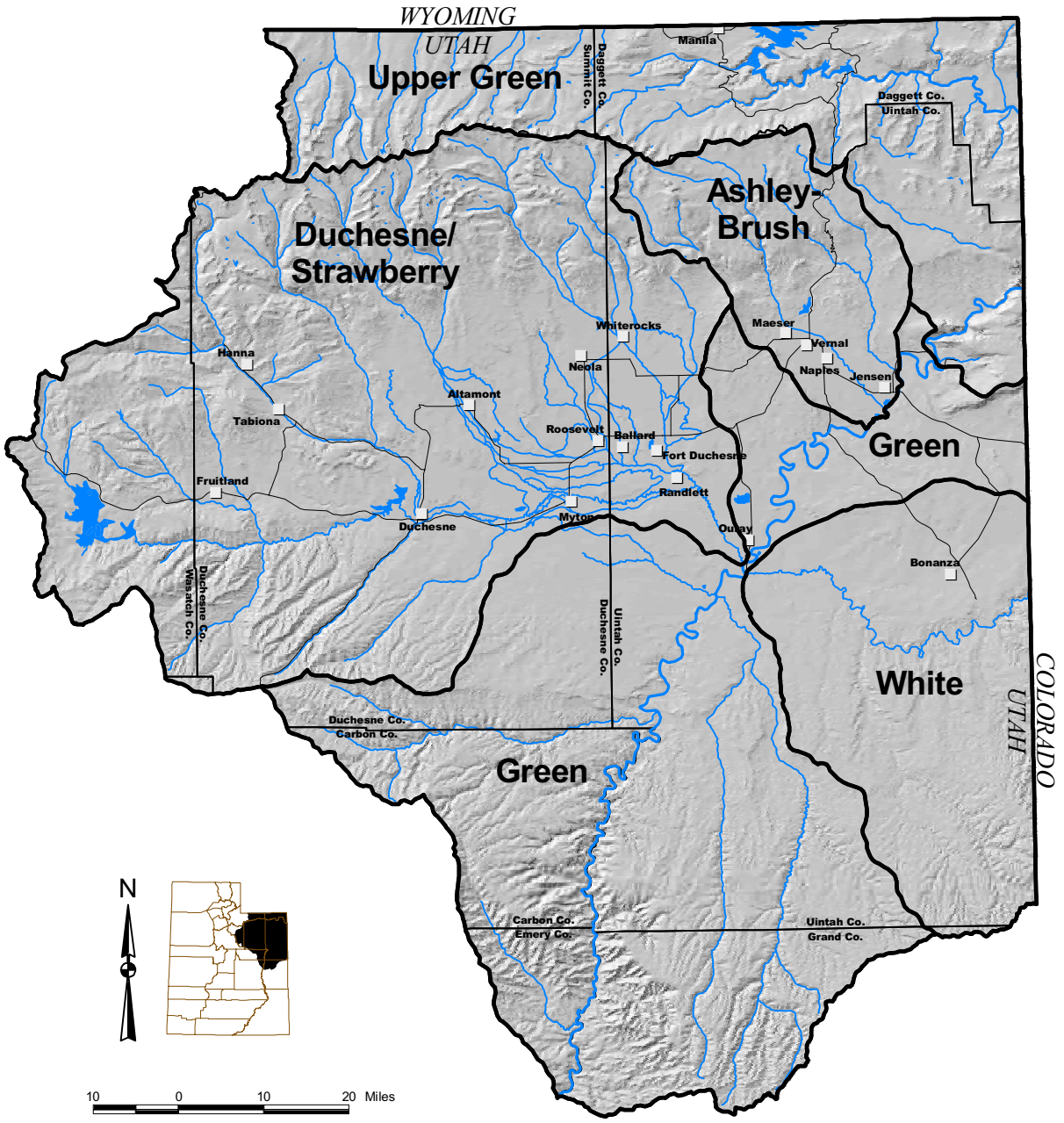


Figure 3-2

Hydrologic Sub-Units

Uintah Basin

The Green River drains the north slope of the Uinta Mountains, while the Duchesne River, its primary tributary, drains the south slope. The White River, also a tributary, drains the eastern Utah border area, along with part of Colorado.

The north slope of the Uinta Mountains has many small streams, such as Blacks Fork, Smiths Fork, Henrys Fork, Beaver Creek, Burnt Fork and Sheep Creek. Some of this water is used for irrigation and municipal and industrial purposes in Wyoming and Utah. The major south slope streams are Currant Creek, Red Creek, Rock Creek, and the Lake Fork, Yellowstone, Uinta, Whiterocks and Strawberry rivers which drain into the Duchesne River, which drains into the Green River. The Vernal area is drained by Dry Fork, Ashley and Brush creeks.

3.3.2 Climate[147,169,73,34]

Mean annual temperatures in the valleys range from 44° to 47° F. Mean monthly maximum temperatures reach 94.6° F in July, and the mean monthly minimum falls as low as 2.5° F in January. The number of frost-free days ranges from 134 at Roosevelt to 57 near Flaming Gorge (see Table 3-1). Mean annual precipitation ranges from 7.1 inches at Roosevelt to 12.5 inches at Flaming Gorge Reservoir. The Uinta Mountains receive about 40 inches. Figure 3-3 shows the climatological reporting stations, and Figure 3-4 shows annual precipitation.

3.3.3 Physiography and Geology[78,47]

The Uinta Mountain range is unique, being the only major range of mountains in North America running east and west. The Uintah Basin is comprised of two provinces; the Uinta Mountain section of the Rocky Mountain Province and the Uinta Basin section of the Colorado Plateau.

The Uinta Mountains are about 150 miles long and 30 miles wide. The broad, massive range was created by anticlinal uplifting, with sedimentary units outcropping on the flanks and dipping outward in all directions. During Pleistocene times, the Uinta Mountains were extensively glaciated, and glacial features dominate the present landscape. Glacial erosion has created many picturesque examples of horns, aretes, cirques and glacial troughs. Deposition by the ice and glacial-melt water has partially filled the many U-shaped valleys with ground moraine and valley trains. It has also lined them with lateral and terminal moraines that have often formed natural dams, creating over a thousand small lakes that dot the region.

Duchesne/Strawberry Sub-Unit

The Duchesne/Strawberry sub-unit lies south of the Uinta Mountains. It is a synclinal topographical basin with an east-west axis running near the south flank of the Uinta Mountains. Elevations at the top of the Roan Cliffs at the southern rim are over 9,000 feet, while the basin floor near Roosevelt is about 5,000 feet in elevation. Although the central portion of the Duchesne/Strawberry Area is gently rolling, there are areas of deeply cut ravines.

Near Red Fleet Reservoir

The Duchesne/Strawberry sub-unit, even though it is considered a plateau, is dissected by many streams. The larger ones include the Duchesne River, Strawberry River, Rock Creek, Lake Fork, and the Yellowstone, Uinta and Whiterocks rivers.

Table 3-1
Mean Temperatures And Precipitation

Station	January Max. (F°)	January Min. (F°)	July Max. (F°)	July Min. (F°)	Mean Annual (F°)	Frost-Free Days[a]	Annual Precipitation[b]
	(mean temperatures)						(inches)
Dinosaur Quarry	29.1	2.5	94.6	55.3	47.4	76	8.47
Duchesne	31.3	5.5	88.1	54.3	46.0	122	9.55
Flaming Gorge	34.6	8.7	85.6	50.4	44.0	57	12.5
Manila	36.0	10.0	87.0	52.0	--	121	9.68
Neola	30.1	6.5	84.6	54.3	44.5	122	8.73
Roosevelt	29.3	3.4	90.9	55.1	46.5	134	7.10
Vernal	28.1	4.9	90.0	53.4	45.5	123	8.16
Ouray	28.7	1.8	94.2	55.6	44.6	142	7.00

[a]Frost-free days are from average spring to first fall frost.
[b]All precipitation values are 1961-1990 normals.
Source: Utah Climate, 1992.

The plateau consists of smooth, gently sloping benches or mesas; alluvial valleys dissected by streams; alluvial fans and foothill slopes that lie between the bases of mesas and the valley plains; rolling uplands; and steep, rough, broken and eroded lands. These different types of relief are not confined to any specific locality, but are scattered throughout the planning area. The mesas and rolling uplands are more extensive in the northern part, and the valleys occur mainly in the eastern and central parts.

Most of the basin floor is between 5,000 and 6,000 feet above sea level; however, it drops to 4,645 feet just south of Ouray. The highest elevation at which crops are grown is about 7,000 feet above sea level, near Mountain Home. Most of the irrigated land occurs on the lower benches and mesas and in the alluvial valleys.

Green Sub-Unit

The Green sub-unit consists of the Tavaputs Plateau and the Green River Valley.

South of the Duchesne River/White River drainages, the Tavaputs Plateau rises to the south with the dip of the Green River formation on which it is cut. The interstream divides are broad and consist of a series of discontinuous cuestas upheld by local sandstones and indurated limey and siliceous zones. Streams and dry washes are deeply incised in canyons. The topography is rugged, with distances of half a mile to a mile between tributary drainages. The area is completely drained, and the largest streams, such as Indian Canyon Creek, Antelope Creek and Nine Mile Creek, are beginning to develop small floodplains along their lower courses. Even the largest streams are trickles at the bottom of canyons almost 1,000 feet deep. Flash floods produce most of the erosion.

The rocks of the Tavaputs Plateau are predominantly creamy to light gray in color, and those of the Upper Duchesne River Plateau are chiefly brick red. This color difference forms a boundary which coincides roughly with the physiographic boundary.

The valley of the Green River comprises a narrow physiographic feature that traverses the basin from northeast to southwest. It is in early maturity where it emerges from Split Mountain to the point five miles southwest of Ouray where it turns southward to transect the Tavaputs Plateau.

The Green sub-unit also contains the Minnie Maud, Argyle, Willow, Nine Mile and Range creeks.

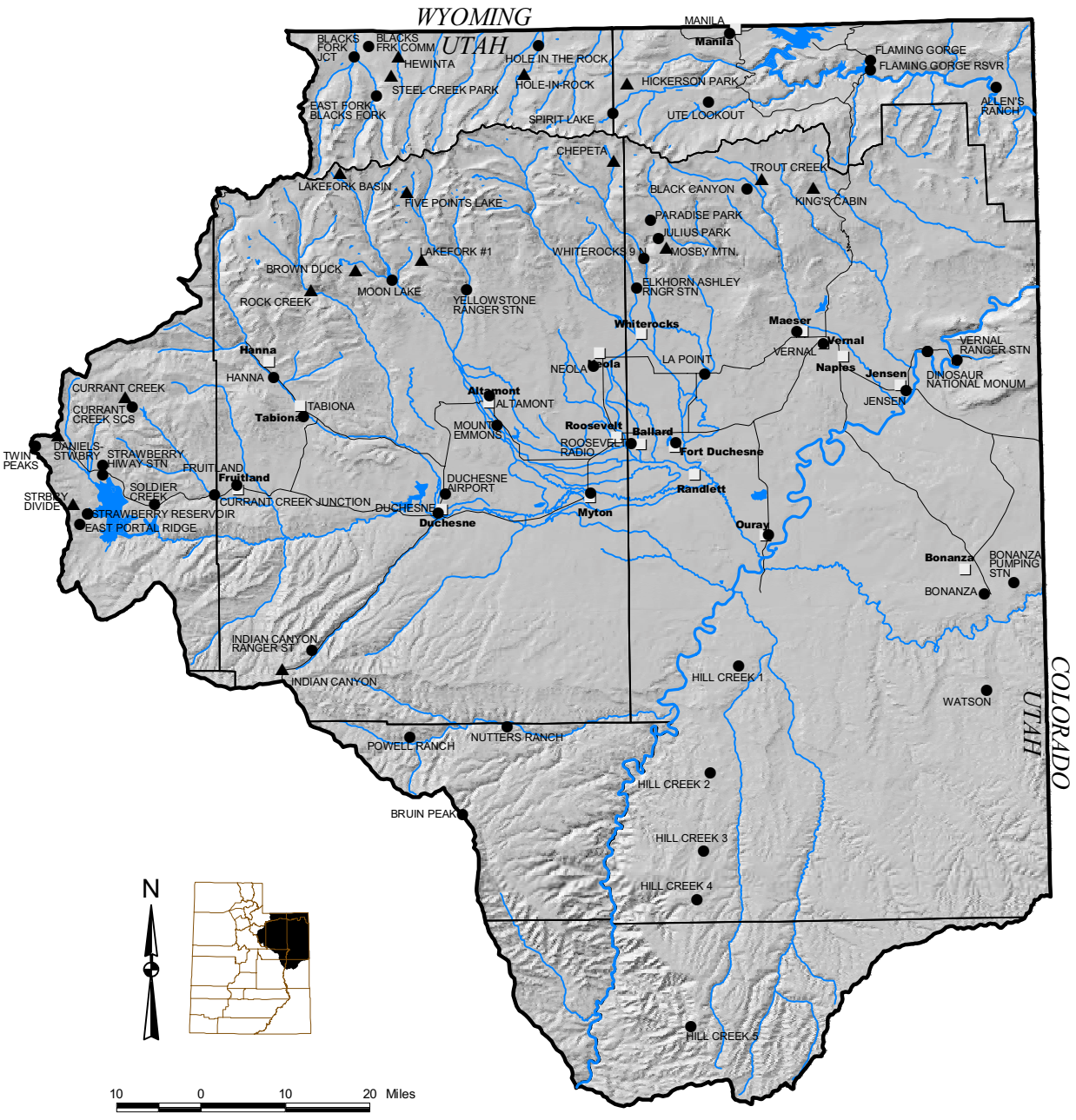


Figure 3-3

Climatological Reporting Stations

Uintah Basin

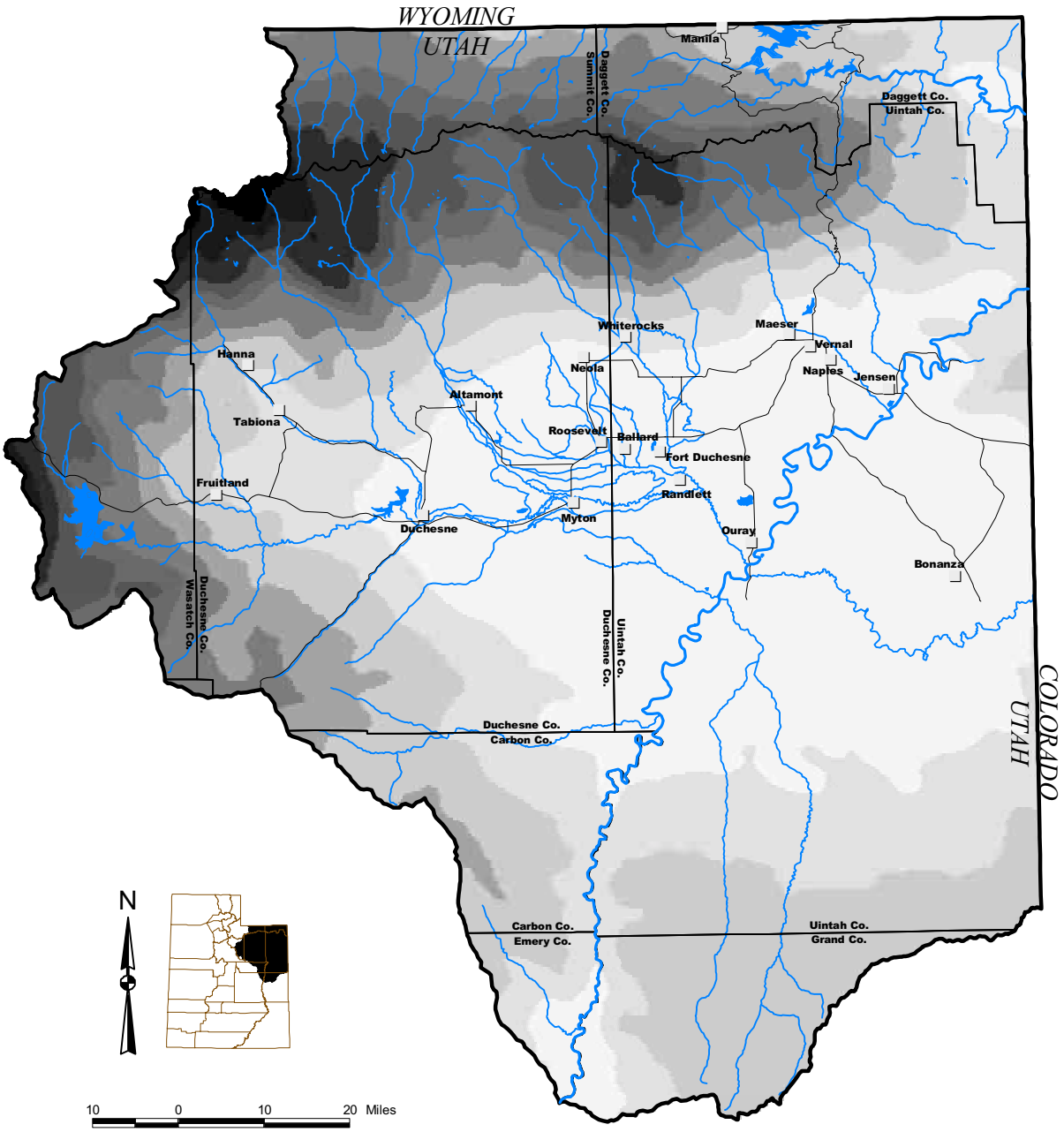


Figure 3-4

Annual Precipitation (1961-1990)

Uintah Basin

Desolation Canyon is the lower area of the Green sub-unit, with its deep, narrow canyons and many rapids.

White Sub-Unit

The White sub-unit lies east of Ouray and the Green sub-unit and consists of the White River drainage and Evacuation Creek. The area is part of the Tavaputs Plateau and the Sweet Water Canyon. The area is rich in oil shale and gilsonite. The Bonanza Power Plant is located near Bonanza about 40 miles south of Vernal.

Rock structure within the area is relatively simple, with a few degrees north westward tilt (dip) of the strata, flattening toward the northwest. High localized permeabilities in some joints have been measured; however, the joints tend to close with depth with a resulting decrease in permeability. The gilsonite deposits near Bonanza occupy some of the northwest-trending joints and faults.

The Town of Bonanza is the nucleus of gilsonite mining in the United States. Gilsonite, also called Uintaite, is a solid hydrocarbon mineral which occurs in narrow vertical veins throughout the region surrounding the project area. These northwest-southeast veins measure up to seven miles long.

Several oil, gas and oil shale fields exist in the sub-unit. There are major federal oil shale leases in Utah that encompass about 10,000 acres and state leases encompassing 14,000 acres.

Tar sand is found in the sub-unit, primarily in the Green River Formation below the oil shale layers. This sand is estimated to contain seven billion barrels of bitumen.

Soils within the sub-unit are of highly erodible desert-type with moderate to low permeability. With the exception of soils in the floodplains of the White and Green rivers and along drainages, the soils of the sub-unit are shallow to very shallow (less than 20 inches) and are on sloping to steep upland terraces containing many areas of rock outcrops and rock escarpments.

Ashley/Brush Sub-Unit

The Ashley/Brush sub-unit lies northwest of Vernal and Jensen. Ashley and Brush creeks were glaciated only in their upper reaches. Downstream from the heads of the valleys, broad U-shaped canyons carved by glaciers give way to extremely narrow precipitous gorges cut entirely by running water. Such gorges are greatly influenced in form and character by the particular rock formation into which they are cut. For example, canyons eroded into the Weber sandstone, one of the prime cliff-forming units in the Uinta Mountains have steep vertical faces with high rugged plateaus. Ashley, Brush and Dry Fork creeks owe most of their grandeur to the Weber sandstone.

The Vernal area is located along Ashley Creek in northeastern Utah. The lands begin north of Vernal and extend southeast to the mouth of Ashley Creek. The surface of the area is smooth and gently slopes to the southeast.

The majority of the soil is formed from alluvial sediments that have been transported into the valley from the Uinta Mountains and the surrounding foothills. They are mainly of medium texture and open structure, with moderate permeability, good available moisture capacity, and relatively low in soluble salt and alkalinity. The inherent fertility is high and capable of producing highly sustained yields (Bureau of Reclamation, 1965).

The Jensen area is located in Uintah County. Most of the arable lands are adjacent to the west bank of the Green River in an area that averages two miles in width and extends five miles in length. Small tracts of arable lands also lie in a narrow valley along the banks of Brush Creek. These extend from Red Fleet Reservoir to a point 15 miles downstream where Brush Creek meets the Green River.

Except for the narrow strips of land adjacent to Brush Creek, all arable lands lie on three distinct and successive benches. These benches were formed mainly by erosion and deposition as the Green River channel intermittently changed and deepened. These lands have a moderate slope favorable to efficient irrigation, but they are underlain by the Mancos formation which contains large amounts of alkalinity.

Many of the tracts along Brush Creek are relatively small and often need their own diversion from the creek. The soils of the irrigable lands are predominantly deep, well-drained, heavy clay loams.

These clay loam soils are fertile and predominantly free from excessive amounts of soluble salts (Bureau of Reclamation, 1965).

Upper Green Sub-Unit

The Upper Green sub-unit lies north of the Uinta Mountains and includes all of Daggett County, which includes a section of Diamond Mountain in the northeast corner of the state. The Green River and Flaming Gorge Dam and Reservoir divide the Upper Green sub-basin. Prior to the construction of Flaming Gorge Dam, only two foot bridges crossed the river, one at Linwood and one at Hideout Canyon. State Highway 191 crosses the dam to Dutch John and then continues on to Rock Springs, Wyoming.

The highest point in the Uinta Mountains in Daggett County is Deadman's Peak (elevation 12,280 feet) in the extreme southwest corner of the county. Eastward from here, for 10 miles to Leidy Peak (elevation 12,013), the elevation of the range averages over 11,500 feet with several prominences of more than 12,000 feet. The mountains have abundant surface water, are dotted with lakes, and are thickly forested. Eastward from Leidy Peak to the broad pass where Utah Highway 44 crosses the range at an elevation of 8,500 feet, the Uinta Mountains rapidly lose elevation and become increasingly arid. From the pass eastward, the range breaks up into isolated ridges and irregular rocky prominences that rise above rolling plateau country. The plateau surface is modified by the drainage of Pot Creek, which flows across the plateau to the east into Colorado, and by numerous streams that plunge precipitously into the Green River to the north. At the east end, the barren mountains reveal more of the somber red hue of their ancient quartzite core.

Lucerne Valley, in western Daggett County, is the most populous portion of the country and contains the town of Manila, the county seat. It is a broad, fertile, alluvium-floored valley developed on the soft Mancos Shale. Roughly paralleling the Wyoming-Utah line, a hogback of Tertiary sandstone and conglomerate separates the valley from the arid Green River Basin of Wyoming to the north. To the south, curving hogbacks of successively older formations rise sharply into the forested foothills of the Uinta Mountains.

The country northeast of the Green River is a continuation of the hogback and broad strike valley pattern of the Lucerne Valley west of the river. Along the Utah-Wyoming line, parallel arcuate hogbacks of Mesaverde sandstone form the feature called "The Glades". To the south of these ridges is Antelope Flats, a continuation of the Mancos Shale strike valley extending west to east. This broad shale-floored valley is constricted by the overriding thrust mass of Goslin Mountain, but it widens again into Clay Basin. Sharply upturned ridges, such as Boar's Tusk and Dutch John Ridge, occur south of Antelope Flats. These ridges are pushed up against and under the great Uinta fault. The country is arid and sparsely vegetated, and the streams are intermittent.

Browns Park, in easternmost Daggett County, is a picturesque, fertile, gravel-floored valley surrounded by somber mountains and plateaus. The Green River issues from Red Canyon into the park from the west and flows out to the south through the slot-like north opening of Lodore Canyon in Colorado. The lowest elevation in Daggett County (5,380 feet) is on the Green River at the Colorado state line.

Geologically, the basin contains rocks of many ages, ranging from Precambrian to Quaternary. Figure 3-5 shows a general geology map of the basin, and Figure 3-6 shows a stratigraphic section of the Uinta Mountains along Highway 191 from Vernal to Manila. Table 3-2 shows the areas of each of the generalized geologic units.

The Uinta Mountains are an anticlinal fold, so the oldest formations form the core of the mountains. Progressively younger formations occur outward from the center.

The Pleistocene deposits are mainly terrace, pediment gravels and glacial outwash from the Uinta Mountains. These deposits are non-saline. In the central part of the basin from Rock Creek east to LaPoint, they overlie the Duchesne River formation.

The Duchesne River formation (of late Tertiary age) consists of interbedded red, brown and vari-colored clay shales, gray-to-buff red-weathering

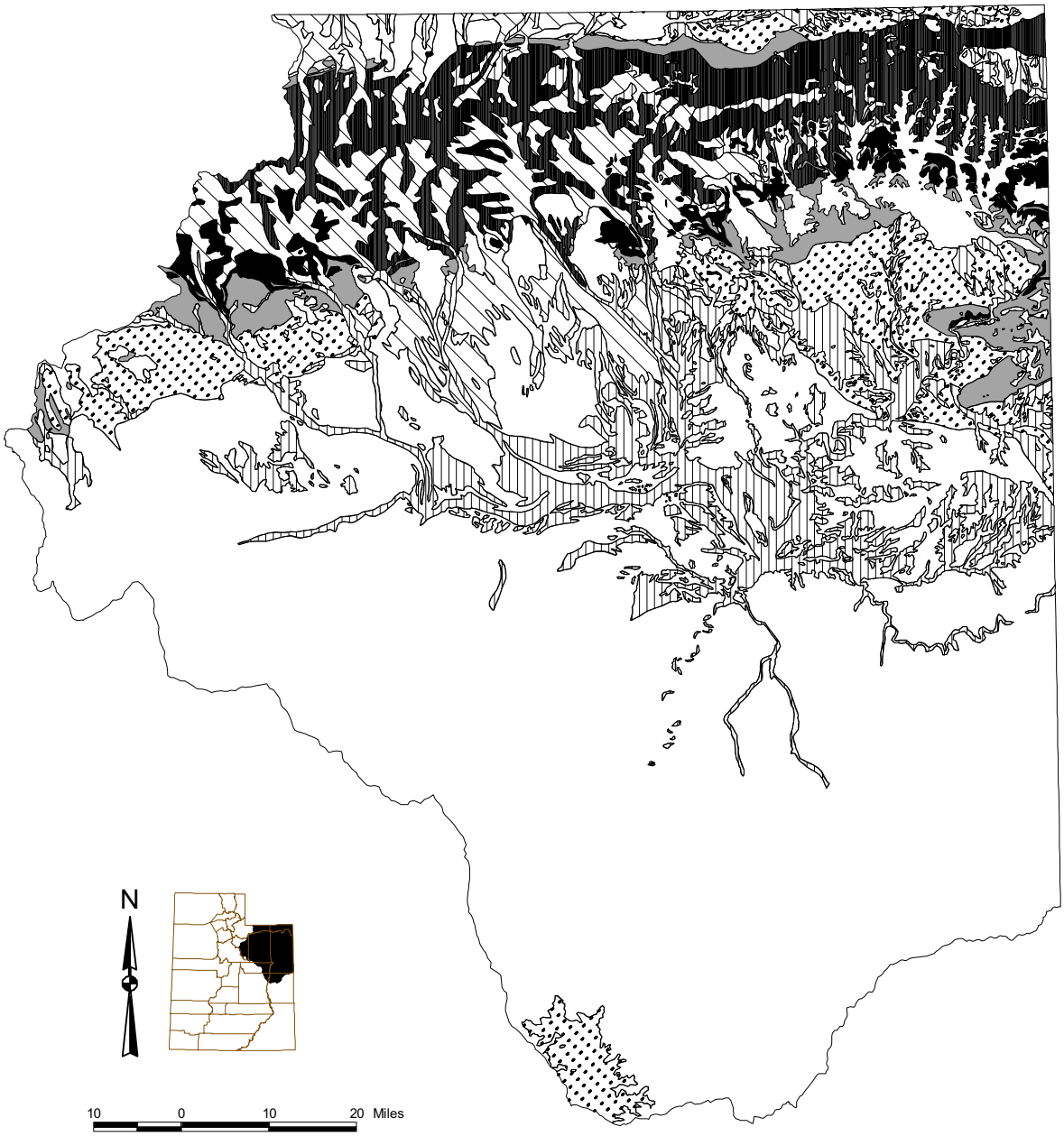


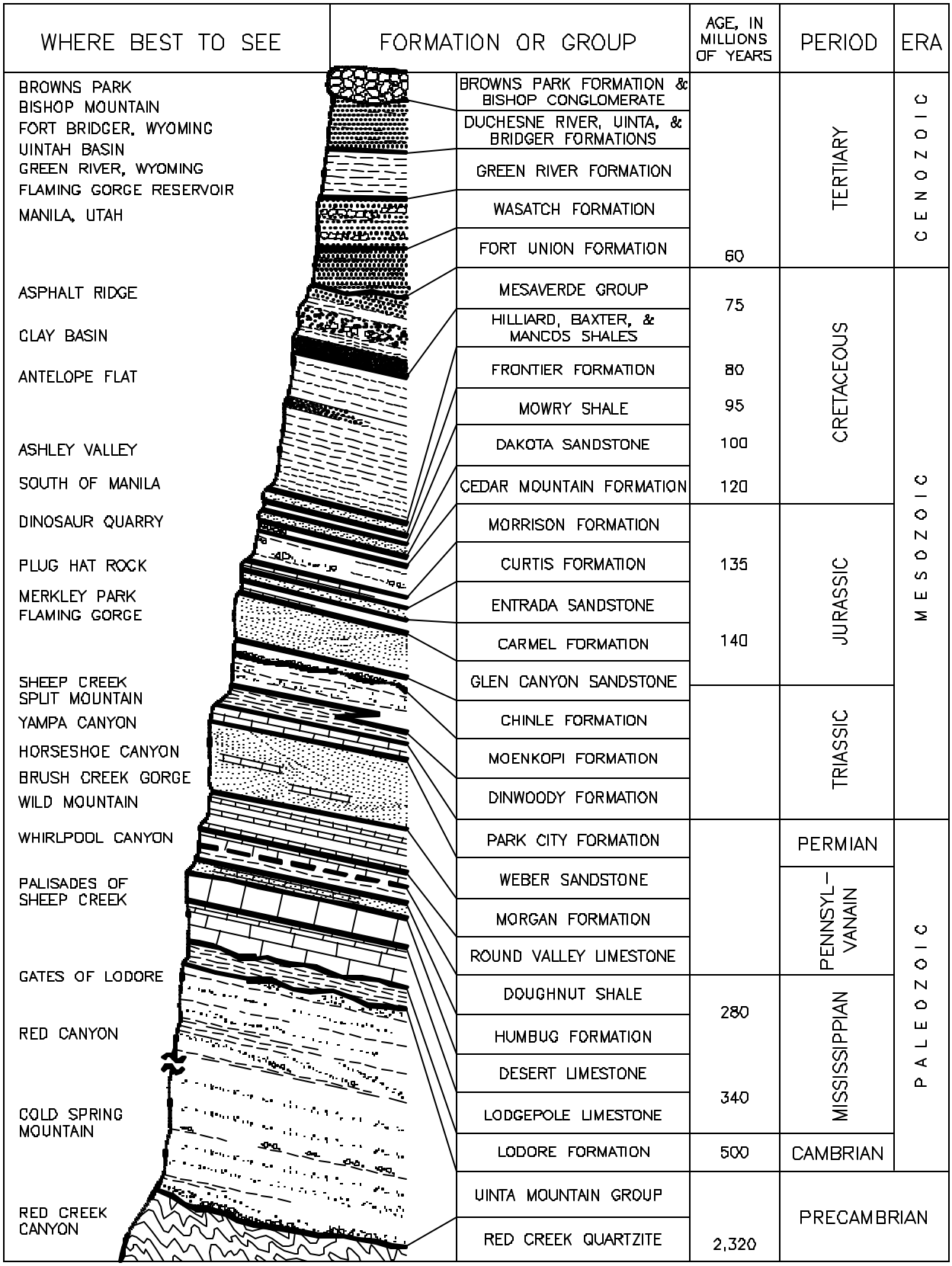
Figure 3-5

Generalized Geology

Uintah Basin

Figure 3–6

UINTA MOUNTAIN STRATIGRAPHIC SECTION



SOURCE: GEOLOGICAL SURVEY BULLETIN 1291

Uintah Basin
Generalized Geologic Units

Quaternary

Qa Unconsolidated deposits of alluvium, colluvium, windblown and landslide origin.

Qg Unconsolidated deposits of glacial origin.

Tertiary

T Weakly to semi-consolidated sedimentary basin-filling rocks of the Browns Park, Bishop Conglomerate, Duchesne River, Uinta, Bridger, Green River and Flagstaff formations.

Mesozoic

M Consolidated sedimentary rocks locally include the North Horn, Current Creek, Mesa Verde Group, Mancos Shale, Frontier Sandstone, Mowry Shale, Dakota, Cedar Mountain, Morrison, Curtis, Entrada, Carmel, Nugget (Navajo), Chinle, Moenkopi and Dinwoody Formations.

Paleozoic

P Consolidated sedimentary rocks locally include the following formations: Park City, Weber Sandstone, Morgan, Round Valley Limestone, Doughnut Shale, Humbug, Deseret Limestone, Madison Limestone, Maxfield Limestone and Lodore Sandstone.

Precambrian

Pc Consolidated sedimentary and metamorphic rocks locally include the following: Red Pine Shale, Uinta Mountain Group and Red Creek Quartzite.

Table 3-2
General Geology
Uintah Basin

Generalized Geologic Units	Total Areas
Quaternary	1,405,380
Tertiary	4,124,500
Mesozoic	465,200
Paleozoic	221,010
Pre-Cambrian	753,510
Totals	6,969,600

Source: Geology data from USGS.

sandstones, and some conglomerates of fluviatile origin derived chiefly from the Uinta Mountain area. Typically not a saline formation, it is a low salt producer. This formation occupies the upper elevations of the south slope of the Uinta Mountains.

The Uinta formation underlies the Duchesne River formation and occupies the central and southern part of the basin. The Uinta formation is composed mainly of gray or green, saline and gypsiferous clays, shales, sandstones and marlstone. This formation is the predominate salt producer in the Uintah Basin.

The Green River formation occurs in the southern part of the basin and consists of sandstone, siltstone, shale and limestone. This formation includes oil, gas, and oil shale deposits and is high in salt content.

The Mesaverde Group of Cretaceous Age is limited in extent. It is exposed west of Vernal and includes Asphalt Ridge. It consists of white, gray and yellow-buff marine sandstones with occasional shale tongues. The formation is rich in commercial bituminous sandstone. Water from petroleum-producing wells in this formation is very saline.

The Mancos Shale formation is Cretaceous in age and exposed mainly in Ashley Valley. This formation is composed of dark gray, saline and gypsiferous clay shales. Infiltration of precipitation is virtually non-existent because of the clay shales. Any water that issues from the formation is saline.

3.3.4 Soil and Land Use

The basin contains approximately 6,969,600 acres of which 201,120 acres are agricultural and 18,170 acres are in residential and industrial. The rest is in forest, range, riparian and wetlands. Table 3-3 shows vegetative cover and land use for each of the five sub-units.

The basin's soils are mostly formed in alluvium from mixed sedimentary rocks on foothills, mountain slopes and alluvial fans. Most are well-drained, but some are poorly-drained and used mostly for summer pastures.

3.3.5 Land Status

Federally administered land is under the jurisdiction of six agencies: the Forest Service (USFS), Bureau of Land Management (BLM), National Park Service (NPS), Fish and Wildlife Service (FWS), Bureau of Indian Affairs (BIA), and the Bureau of Reclamation (BR). They administer about 58 percent of the basin lands. Eight percent is administrated by state government, 15 percent is Indian land held in trust by DOI for the Ute Indian Tribe, and 19 percent is private land. Land status is shown in Table 3-4, along with acreage in each sub-unit.

3.4 Water-Related History

The first white men to visit the area came with the Dominguez Escalante Expedition in 1776. Led by Catholic priests, the purpose of the journey was to find a new route from Santa Fe to California. Journal entries tell of the group reaching the present site of Strawberry Reservoir and descending by way of Sixth Water Creek into Diamond Fork, the Spanish Fork River and eventually to Utah Lake. This is the route by which present day CUP water reaches the Wasatch Front. Escalante's expedition was followed by the fur trappers in the early 1800s. The first of these was William Henry Ashley, for whom Ashley Valley is named.

3.4.1 Early Water Development

The Uintah and Ouray Indian Reservation was established by executive order of President Lincoln on October 3, 1861. Between 1902 and 1905, reservation lands were allotted to individual Indians and the unallotted lands returned to the public domain. As a result, Indian and non-Indian lands are interspersed. Many of the present administrative and water rights issues had their beginnings in the homesteading of the Indian reservation.

In 1905 the U. S. Government opened the lands for homesteading. In that year, the first non-Indian settlers arrived in the Duchesne River area. That same year, two irrigation groups filed for water rights in the Duchesne area.

The first irrigation systems were relatively small projects constructed with horse-drawn plows and scrapers. Larger and longer canals were constructed as the demand for land and water grew. The first water was diverted from the basin in 1869. Three canals diverted water from the Strawberry

Table 3-3
Vegetative Cover and Land Use

Vegetative Cover	Upper Green River	Ashley/ Brush Creek	Duchesne/ Strawberry River	Green River	White River	Total
			(acres)			
Agriculture	17,860	27,680	143,610	10,940	1,030	201,120
Residential/Industrial	1,110	7,190	9,430	360	80	18,170
Idle	10,950	7,090	113,840	40,850	24,640	197,370
Wet/Open	18,740	3,080	32,020	6,710	1,260	61,810
Riparian	960	1,060	23,130	5,040	2,440	32,630
Salt Desert	3,700	57,720	166,890	667,010	329,720	1,225,040
Blackbrush	0	0	0	2,820	0	2,820
Sage/Grass	251,430	118,090	604,970	529,300	222,140	1,725,930
Grassland	19,010	2,350	83,540	38,780	1,430	145,110
Pinyon/Juniper	107,640	35,790	437,970	784,220	185,970	1,551,590
Oak	2,840	0	7,630	168,160	42,740	221,370
Mountain Shrub	270	590	15,900	1,970	0	18,730
Aspen	7,990	6,100	231,500	46,340	0	291,930
Mixed Conifer/Aspen/Shrub	1,570	800	23,790	34,120	6,120	66,400
Conifer Forest	378,210	147,540	468,810	97,140	1,670	1,093,370
Alpine	37,480	6,640	72,090	0	0	116,210
Totals	859,760	421,720	2,435,120	2,433,760	819,240	6,969,600

Source: Utah State University GAP/EPA, 1995.

Table 3-4
Basin Land Ownership And Administration

Land Owner	Upper Green River	Ashley/ Brush Creek	Duchesne/ Strawberry River	Green River	White River	Total Uintah Basin	Total (per-cent)
			(acres)				
Forest Service	459,870	205,250	1,028,280	16,370	0	1,709,770	25
Private	113,330	87,740	791,220	276,810	61,190	1,330,290	19
Bureau of Land Management	154,120	106,280	69,310	1,300,020	555,670	2,185,400	31
State Lands	55,020	22,070	112,640	290,630	107,180	587,540	8
National Parks/Monuments Recreation/Wildlife Areas	77,410	390	10	57,830	0	135,640	2
Indian Reservation	0	0	482,930	492,110	45,920	1,020,960	15
Totals	859,750	421,730	2,484,390	2,433,770	769,960	6,969,600	100

Source: Utah State University, Geography Department, 1996.

River drainage to Daniels Creek. Two of these canals, Strawberry River Canal and Willow Creek Canal, were commingled in 1954 to form a single canal. Hobble Creek Ditch is the third diversion. These diversions ceased when water was replaced from the Jordanelle Reservoir under the Central Utah Project.

From the beginning of settlement in the early 1900s, irrigation has been needed to sustain agriculture. However, while arid in climate, the Uinta Mountains actually receive an abundant supply of precipitation. The annual flow of most streams from the Uinta Mountains exceeds the local demand. Most of this flow, however, occurs as uncontrolled spring runoff. As summer progresses, the supplies diminish below the requirements of the crops.

Since early days, attempts have been made to store a part of the spring excess for use in late summer. These efforts include the construction of Moon Lake Reservoir, the enlargement of many of the high mountain lakes, and the construction of Midview (Lake Boreham) and Big Sand Wash reservoirs. Together with many smaller private and Indian reservoirs, these facilities have provided valuable but still insufficient storage of the surplus spring runoff.

Water rights filings were made in the State Engineer's Office in 1905 for two areas in the Duchesne area. The first filing was the Holgate or Pioneer Ditch, which diverts from the Duchesne River some six and one-half miles east of Duchesne. This water irrigated some land before reaching the Holgate Flat, later called Midview. The second filing was for the area under the Rocky Point Ditch Company. This canal diverts water from the north side of the Duchesne River at a point five miles north of Duchesne and irrigates land above and east of Duchesne as far as the Holfeltz Ranch almost nine miles down the river. There were 22 water right filings for this ditch, and construction began early in the summer of 1906. It was 1909 before the ditch was in satisfactory operating condition.

Water for the town of Duchesne was diverted into a ditch on the Duchesne River about one-half mile above the town in 1905. In 1917 the city of Duchesne constructed a new water system. This system had a cistern, or storage supply, on Blue Bench north of town to give the necessary pressure, with the water supply being taken out of the Rocky Point Ditch.

The Myton area was opened for homestead entry in September 1905, and a price of $1.25 per acre was charged for the land. An Indian trading post had been established near the present Myton townsite and was called "the Bridge," since it was near the only bridge that spanned the Duchesne River. The post gradually expanded into a town that was given the name of Myton in honor of H. P. Myton, who was at one time in charge of Indian affairs on the reservation.

Hanna and Tabiona, two small farming communities on the upper Duchesne River, were both established in the fall of 1905. Tabiona was named after Chief Tabby who was the chief of a large local Indian tribe. Hanna received its name from early colonizers known by that name. Immediately after the area was settled, small irrigation ditches were dug to divert water from the Duchesne River and its tributaries onto the parched soil. It was evident to the homesteaders that irrigation water was essential to successful agriculture.

Construction of high mountain dams began in the spring of 1917 in the Brown Duck drainage with construction of Brown Duck, Island and Kidney Lake dams by the Farnsworth Canal and Reservoir Company. The Dry Gulch Irrigation Company later constructed Clement Dam in Clement Basin.

During the 1910s and 1920s, 10 more dams were constructed in the Yellowstone (Garfield) and Swift Creek basins by Farmers Irrigation Company and a private dam (Milk Lake) by Chester Hartman. A total of 14 dams were completed for a total storage of 4,600 acre-feet.

The Indian Irrigation Service became alarmed with reduced flows in Lake Fork and Yellowstone rivers, due to upstream diversions. A 1923 federal court decree (Dockets 4427 and 4418) gave the Uintah Indian Irrigation Project lands the first priority to water. Thus the percolating waters feeding the streams could not be diminished because the Uintah Indian Irrigation Project had first water rights. Through negotiation between the irrigation companies and the Uintah Indian Irrigation Project, three acre-feet per acre of irrigation water was

apportioned for each acre of Indian irrigated land. Secondary water rights also received three acre-feet of water for each acre of irrigated land, as long as there was water in the stream.

In dry years, only the first water rights could be filled. As a remedy, the Farnsworth Canal and Reservoir Company constructed Twin Pots Dam; and later in 1937 the Bureau of Reclamation constructed Moon Lake Dam and Reservoir. The two reservoirs provide storage of surplus water and allow for more efficient use of irrigation water.

The city of Roosevelt, founded in 1906, is situated on the lower extremity of a fertile mesa seven miles west of the Uinta River. The east and west branches of Dry Gulch Creek form a junction at the foot of this tableland, and it drains the valley surrounding the city.

At the time of settlement, all the people in and around Roosevelt hauled their culinary water in barrels from a spring southwest of town. The citizens of the community later stored the waters of the Uinta River in a tank at the highest point on the bench, from which the water was conveyed through the streets in wooden pipes. On November 17, 1915, the city council decided to drill a well near the reservoir site. Since then, other wells have been drilled east of the town of Neola and water has been pumped into the reservoir.

Domestic water was supplied to Vernal and adjoining communities from Ashley Spring on Ashley Creek just above Utah Power's hydroelectric power plant. A steel pipe, with a capacity of seven cfs, conveyed water to the head works of the distribution system. Many farmers hauled their culinary water, and a few obtained it from irrigation ditches.

Ashley Creek is characterized by high discharges from snowmelt in May and June followed by rapidly receding flows that fall far below irrigation requirements. As early as 1888, efforts were made to develop storage for the erratic water supply. To date, there is 41,500 acre-feet of storage capacity available on Ashley Creek. This is provided in a group of small glacial lakes (Long Park, Twin and Goose lakes) on the headwaters of Ashley Creek (1,100 acre-feet) and Steinaker Reservoir with 40,400 acre-feet. An additional 5,740 acre-feet of capacity is provided for the Vernal area in Oaks Park Reservoir on Brush Creek, which lies north of Ashley Creek. Water is conveyed by the Oaks Park Canal from the reservoir to Ashley Creek. Municipal and industrial water (18,000 acre-feet) can be imported from Brush Creek via Red Fleet Reservoir and the Tyzack Aqueduct.

Presently irrigated lands in the Vernal area are served by six major canals and ditches that divert flow from Ashley Creek. These include the Ashley Upper, Ashley Central, High Line and Rock Point canals and the Island and Dodds ditches. In addition to the diversions by the main canals and ditches, some small diversions are made by individuals or small groups of private interests. In the southern portion of Ashley Valley, the Union and River canals supply some small areas at times of high water flows from Ashley Creek and return flows from irrigated lands.

The Nine Mile area is located south of Roosevelt and Vernal and drains the West Tavaputs Plateau. The main farming activity in this area is cattle. One of the few real cattle kings of the west was Preston Nutter, whose business centered around Nine Mile. Because of the narrow canyons and sparse vegetative cover, the land is always susceptible to flash floods, especially in late summer.

Much like Nine Mile, the main industry of Manila is cattle. From the time of the first settlement, water has been a problem. For culinary use, the town built a cistern and dug a tunnel to collect the seepage from a strata of shale north of the town. This water was piped from the cistern into the town. This pipe supplied a 2,000 gallon tank located in town. From this tank, the townspeople obtained their culinary water and watered their livestock. The system has been continually upgraded over the years, and culinary water is now piped from Long Park Reservoir to a filtration plant and then on to Manila.

3.4.2 Federal Water Projects

The Uintah Indian Irrigation Project, constructed by the Bureau of Indian Affairs (BIA), was started in 1906 and completed in 1920. The project, constructed with 21 canals and laterals, is much the same today. The BIA manages, operates and maintains the canals and laterals. Irrigation water is delivered to the users through this system.

The Strawberry Valley Project, which diverts water from the Uintah Basin to the Bonneville Basin (Utah Valley sub-area in the Utah Lake drainage area), was one of the earliest federal reclamation developments. Construction began in 1906, and water was first used in 1915. Water was collected in the 270,000 acre-feet of active storage capacity in Strawberry Reservoir which was formed by a dam on the Strawberry River, a tributary of the Duchesne River. Additional water was brought to the reservoir from Indian and Currant creeks through feeder canals. The Strawberry (Syar) Tunnel, which is 3.7 miles long, extends from the reservoir to Sixth Water Creek which is tributary to Diamond Fork and thence the Spanish Fork River. Released storage water is re-diverted from the Spanish Fork River and used for irrigation primarily in Southern Utah Valley. A small amount of the stored water was conveyed to Goshen Valley.

The construction of Moon Lake Dam was completed under the Moon Lake Project (Bureau of Reclamation) in late 1937. The earthfill dam is located approximately 13 miles northwest of the community of Mountain Home and stores water from Lake Fork River which is tributary to the Duchesne River. The active capacity of the reservoir is 35,760 acre-feet, while the dead storage is an additional 13,740 acre-feet. The Yellowstone Feeder Canal, Midview Dam (Lake Boreham) and the Midview Canal System were also part of the Moon Lake Project. The water stored in these reservoirs is released for irrigation on lands under the Moon Lake Water Users Association and Uintah Indian irrigation projects. The natural flow the Indians are entitled to is passed through the reservoir. These lands irrigated by this project are located in the vicinity of Roosevelt.

Water is exported through the Duchesne Tunnel as part of the Provo River Project, from the North Fork of the Duchesne River, a tributary of the Green River and eventually the Colorado River. The tunnel begins 21 miles due east of Kamas and extends six miles under a spur of the Uinta Mountains. The outlet is into the main stem of the Provo River (Utah Lake drainage area), upstream from Heber City. The Duchesne Tunnel was completed in 1953 and began delivering water for the 1954 irrigation season. Its maximum capacity is 600 cubic feet per second (cfs). In the North Fork of the Duchesne River, at the point of diversion, over 70 percent of the annual flow occurs during May and June. The tunnel usually begins transporting large quantities of water in early May. The average annual diversion has been about 22,300 acre-feet.

Construction of the Vernal Unit, which is a portion of the initial phase of the Central Utah Project, was initiated during 1959 and completed in 1962. The principal feature of the project is Steinaker Dam, located in Steinaker Draw four miles north of Vernal. The earthfill dam is 140 feet high and impounds 37,200 acre-feet, of which 33,280 acre-feet is usable. Water is diverted from Ashley Creek at the Fort Thornburgh Diversion Dam into the 400 cfs Steinaker Feeder Canal and then into Steinaker Reservoir. The 300 cfs Steinaker service canal conveys the flows from the outlet works of Steinaker Dam throughout Ashley Valley, with water being released to agricultural lands at numerous points along the canal.

The Colorado River Salinity Control Program was started in 1980.[106,95] This program provides financial and technical assistance to identify salt source areas in the Colorado River Basin and to install conservation practices to reduce salinity levels in the Colorado River. The Salinity Control Program in the Duchesne River drainage has treated about 90,000 acres at a cost of $41 million (1997), and it has reduced the salt load in the Colorado River by about 92,000 tons per year. The original goal of the Salinity Control Program was to treat 137,000 acres and to reduce the salt load by 111,000 tons per year. Funding for the project has been reduced, but the goal is still obtainable.

Flaming Gorge Dam is located on the Green River in northeastern Utah about 32 miles downstream from the Utah-Wyoming border. The reservoir formed by the dam extends up the Green River to a point near Green River, Wyoming. The dam was completed in 1962 and began storing water on November 1 of that year. The active capacity of the reservoir is 3,516,000 acre-feet, and the dead storage is an additional 273,000 acre-feet.

Flaming Gorge Dam and Reservoir have multi-purpose objectives. As part of the Colorado River Storage Project, they are part of a long-range basinwide program to develop the water resources of

the Upper Colorado River System, regulate the flows of the Green River, and produce hydroelectric power for financing the basinwide water resources program of the Upper Colorado River System.

Starvation Dam, which is part of the U. S. Bureau of Reclamation Bonneville Unit of the Central Utah Project, was completed in 1970. This structure stores high runoff water from the Strawberry and Duchesne rivers, provides supplemental late season storage, and will also provide replacement water for cropland along the Duchesne River in exchange for Bonneville Unit water that is exported to the Wasatch Front.

Upper Stillwater and Currant Creek reservoirs were completed in 1987 and 1977, respectively. These reservoirs store and regulate water from Rock Creek and Currant Creek drainages, respectively. The Strawberry Aqueduct collects runoff from these reservoirs and the south slope of the Uinta Mountains west of Rock Creek or between these reservoirs and conveys the water to the enlarged Strawberry Reservoir for storage and export to the Wasatch Front. The Strawberry Reservoir enlargement was completed in 1974 and filled for the first time in 1998.

3.4.3 Water Districts

Most of the land within the Uintah Basin study area is within the boundaries of the Central Utah Water Conservancy District. The Uintah Water Conservancy District, established in 1956, includes all of Uintah County, except a small area known as the Moon Lake Exclusion in western Uintah County. Duchesne County organized the Duchesne County Water Conservancy District in 1998. ❑

Contents

Section 4

Uintah Basin Plan

Utah State Water Plan

Demographics and Economic Future

The basin's demographics are contrasted by small farming communities nestled around larger communities such as Duchesne, Roosevelt, Vernal and Manila.

4.1 Introduction

This section discusses the population, employment and economic future of the Uintah Basin. The basin has been plagued with boom and bust -- first the oil boom and then the anticipated oil shale boom. Oil is still being produced but at a much reduced production level, and oil shale mining is not currently being pursued by any major company.

4.2 Demographics[161]

The Uintah and Ouray Indian Reservation comprises a large land area in the basin. Due to the Homestead Act of 1905, many farms and communities were established by non-Indians within the reservations.

Basin population for 1998 was 39,596. By 2020 the total is projected to be 54,706, an increase of 15,855 people or 29 percent. The annual rate of growth in population is expected to be 1.3 percent. This compares to the statewide average of 2.2 percent.

The employment pattern will probably remain about the same, with non-farm proprietors, services and trade gaining at a more rapid rate while agriculture declines. Construction is expected to triple employment. Overall employment is expected to increase by about 10,200 jobs by the year 2020, which is about an average annual growth rate of growth of about 1.7 percent, compared to the state average of 3.3 percent.

The Governor's Office of Planning and Budget (GOPB) prepared the projected population and employment estimates used in this plan. These estimates were then used as a basis for estimating the future culinary water supply requirements shown in Section 11 - Drinking Water. The 1990 census is the basis for all population estimates. The basin population is considered to comprise all of Daggett, Duchesne and Uintah counties. The major population centers are in Duchesne, Uintah and Daggett counties.

The Governor's Office of Planning and Budget has developed the procedures and criteria for making population projections. The Utah Process Economic and Demographic (UPED) model is part of this. Local planners in the Association of Governments (AOG) office prepared the population estimates for GOPB review. The projection model takes into account many variables regarding the demographics and industrial mix of an area. This model incorporates historical employment growth rates into the future growth patterns. Assumptions regarding labor force participation rates, non-employment related migration rates, and constant age-specific fertility and survival rates are also incorporated.

Duchesne[38] and Roosevelt contain 44 percent of the total Duchesne County population. Vernal comprises 30 percent of Uintah County's population, and Manila comprises 33 percent of Daggett County's population. Vernal is the largest city in the basin.

Between 1990 and 1994, Duchesne City, in Duchesne County, had the fastest growth of any city in the basin at 24 percent. The fastest growing community in Uintah County was Naples at 14 percent. Manila, in Daggett County, grew 15 percent during this time period, and unincorporated portions of the basin gained 7 percent for the same period.

Community populations and long-range projections are shown in Tables 4-1 and 4-2. The initial methodology used to allocate the city populations within a county involved a simple average of the 1990 Census city share as a percentage of the county and an average 10-year growth rate. Figure 4-1 presents the information in graphic form.

4.3 Employment

Total employment in Daggett County[67] is expected to increase 77 percent between 1995 and 2020; that is an increase from 493 to 875 jobs. Thirty-three people are currently employed in agriculture, and a slight decrease is expected. Construction jobs will multiply from 2 to about 60. Manufacturing will reduce jobs from 12 to 3. Transportation, communication and public utility jobs (TCPU) will increase from 30 to 60, and trade will increase from 18 to 79 jobs. Service employment will nearly triple from 80 to 217. Government jobs are expected to increase from 191 to 325.

Duchesne County can be expected to lose about 100 agricultural jobs, down to 800 in 2020. Mining will lose employment from 475 to 153 during the projected period. Employment in construction, manufacturing and TCPU will more than double, reaching 422, 327 and 807, respectively, by 2020. Trade employment will grow from 920 to 1,632, while finance, insurance and real estate (FIRE) will increase from 105 to 175. Government and non-farm proprietors employment will gradually increase throughout the projection period.

In Uintah County, agricultural employment is expected to lose 82 jobs, ending in 2020 at 675. Mining is expected to lose about 337 jobs by 2020, and construction employment will increase from 263 to 613. Manufacturing jobs will also increase by 166. Employment in transportation, communication and public utilities (TCPU) is expected to increase by about 300 jobs by 2020, going from 648 to 946. Trade jobs will increase from 1,892 to 3,297. Service jobs are expected to increase from 1,729 to 3,701. Government employment will increase 38 percent, from 1,736 in 1995 to 2,404 in 2020. Total employment is expected to rise from 10,747 to 17,192 by 2020. Table 4-3 and Figure 4-2 show employment projections.

At 7.9 percent, the unemployment rate for this basin is higher than any other region of the state. Duchesne County has the second highest unemployment rate of any county in the state with 9.3 percent in 1995.

4.4 Economic Future

The long-term outlook for the economy of the basin is positive. New businesses are developing in the basin. Manila should continue to grow, due to the Flaming Gorge National Recreation Area. The rest of the basin is also experiencing growth. Migration of people from the basin to the Wasatch Front will likely occur, but this migration will be countered by people who work in the metropolitan areas (through telecommunication) but choose the more rural counties as places to locate their families. Also, people are moving back from the Wasatch Front and retiring in the basin. Summer homes and cabins are being built in the Tabby Mountain area and between Starvation and Strawberry reservoirs. A new phosphate plant on Taylor Mountain is also being planned. ❑

Table 4-1
Population Projections
Uintah Basin

County	1990	1998	2020
Daggett			
Manila Town	207	256	382
Balance of Daggett County	483	577	862
County Total	690	833	1,244
Duchesne			
Tabiona Town	120	137	181
Roosevelt City	3,915	4,292	5,683
Myton City	468	519	687
Duchesne City	1,308	1,447	1,916
Altamont Town	167	192	254
Balance of Duchesne County	6,667	7,683	10,174
County Total	12,645	14,270	18,895
Uintah			
Vernal City	6,640	7,111	10,036
Naples	1,334	1,466	2,069
Ballard Town	644	735	1,037
Balance of Uintah County	13,593	15,181	21,425
County Total	22,211	24,493	34,567
Basin Total	35,546	39,596	54,706

Table 4-2
Long-Range County Projections

County	1990	1998	2020	2050
Daggett	690	833	1,244	2,183
Duchesne	12,645	14,270	18,895	28,426
Uintah	22,211	24,182	34,567	56,411
Basin Total	35,546	39,285	54,706	87,020

Figure 4-1
Population Projections

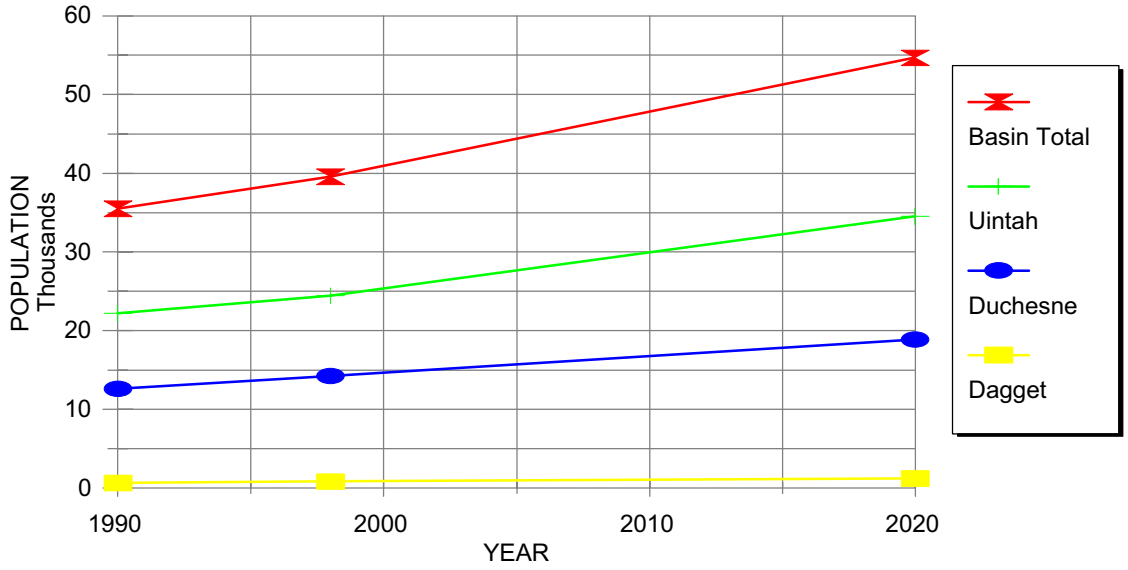


Figure 4-2
Employment Projections

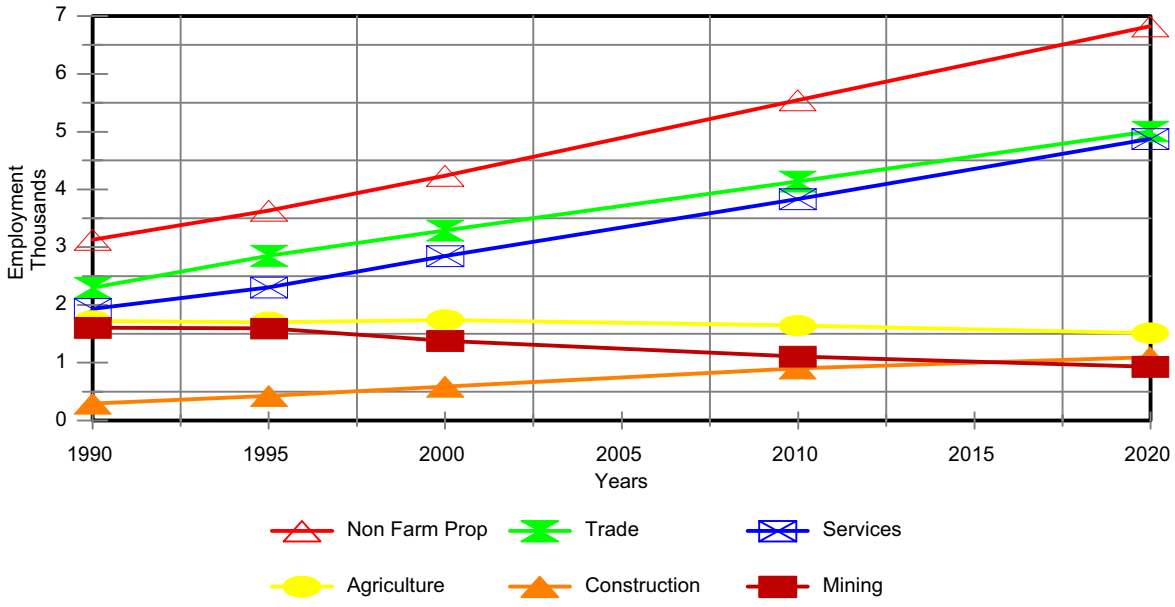


Table 4-3
Employment Projections
Uintah Basin

County	1990	1995	2000	2010	2020
Daggett					
Agriculture	33	33	34	32	29
Mining	0	0	0	0	0
Construction	2	18	28	50	62
Manufacturing	12	2	2	3	3
TCPU	30	41	45	53	60
Trade	18	42	50	64	79
FIRE	0	1	1	1	2
Services	80	97	123	167	217
Government	191	209	223	272	325
Non-Farm Proprietors	64	50	60	78	98
County Total	430	493	566	720	875
Duchesne					
Agriculture	924	910	931	881	811
Mining	448	475	384	241	153
Construction	102	153	216	349	422
Manufacturing	138	250	263	290	327
TCPU	397	435	514	659	807
Trade	796	920	1,074	1,351	1,632
FIRE	136	105	120	147	175
Services	466	480	579	766	956
Government	1,214	1,512	1,529	1,759	2,116
Non-Farm Proprietors	1,138	1,343	1,586	2,082	2,559
County Total	5,759	6,583	7,196	8,525	9,958
Uintah					
Agriculture	769	757	775	733	675
Mining	1,161	1,118	995	869	781
Construction	197	263	343	507	613
Manufacturing	195	245	291	342	411
TCPU	598	648	604	769	946
Trade	1,486	1,892	2,174	2,726	3,297
FIRE	110	119	134	162	193
Services	1,387	1,729	2,147	2,906	3,701
Government	1,623	1,736	1,731	2,020	2,404
Non-Farm Proprietors	1,927	2,240	2,596	3,390	4,171
County Total	9,453	10,747	11,790	14,424	17,192
Basin Total	15,642	17,823	19,552	23,669	28,025

[1]Source: Governor's Office of Planning and Budget, State of Utah, Economic and Demographic Projections, 1997.

Contents

Section 5

Uintah Basin Plan

Water Supply and Use

The primary feature of this hydrologic system is the Green River. All of the streams in this basin flow into the Green River.

5.1 Introduction

Most of the water used in the basin is for agricultural, municipal and industrial purposes and comes from streams originating in the Uinta Mountains. Water is stored for use in Long Park, Strawberry, Starvation, Currant Creek, Upper Stillwater, Big Sand Wash, Moon Lake, Steinaker, Red Fleet reservoirs and many other small reservoirs. Figure 5-1 shows the major rivers, streams and water impoundments. Figures 5-2 and 5-3 show the quantity of flows into, through and out of the Uintah Basin.

Steinaker Reservoir

5.2 Background

Population growth and development of the basin's natural resources have brought an increase in water demand. This demand is being met by the combined efforts of irrigation companies, cities and water conservancy districts. Federal and state agencies have played a prominent role in constructing water storage and delivery facilities.

5.3 Water Supply

The water delivery systems range from simple to complex. Major aqueducts and large storage reservoirs enhance most irrigation and municipal systems. Small systems consisting of pumps and earthen ditches have also been developed. Table 5-1 shows average annual stream flows for the Uintah Basin.

5.3.1 Surface Supply[164,4]

The Green River is the largest river in the Uintah Basin. The Duchesne and White rivers are large tributaries flowing into the Green River. The Yampa also flows into the Green River from Colorado, with its headwaters in the Colorado Rockies.

Numerous lakes are near the crest of the Uinta Mountains. Forty-seven of these small, natural lakes have been fitted with dams and outlet works and now function as storage reservoirs. The combined regulated capacity of these lakes is about 17,000 acre-feet. Most of these reservoirs were constructed in the early 1900s by local irrigation companies. Fifteen of these lakes will be stabilized (constant water level) as part of the Central Utah Project Completion Act, if the reduced Uintah and Upalco units are constructed, and will be used for fish, wildlife and other recreational purposes. Flaming

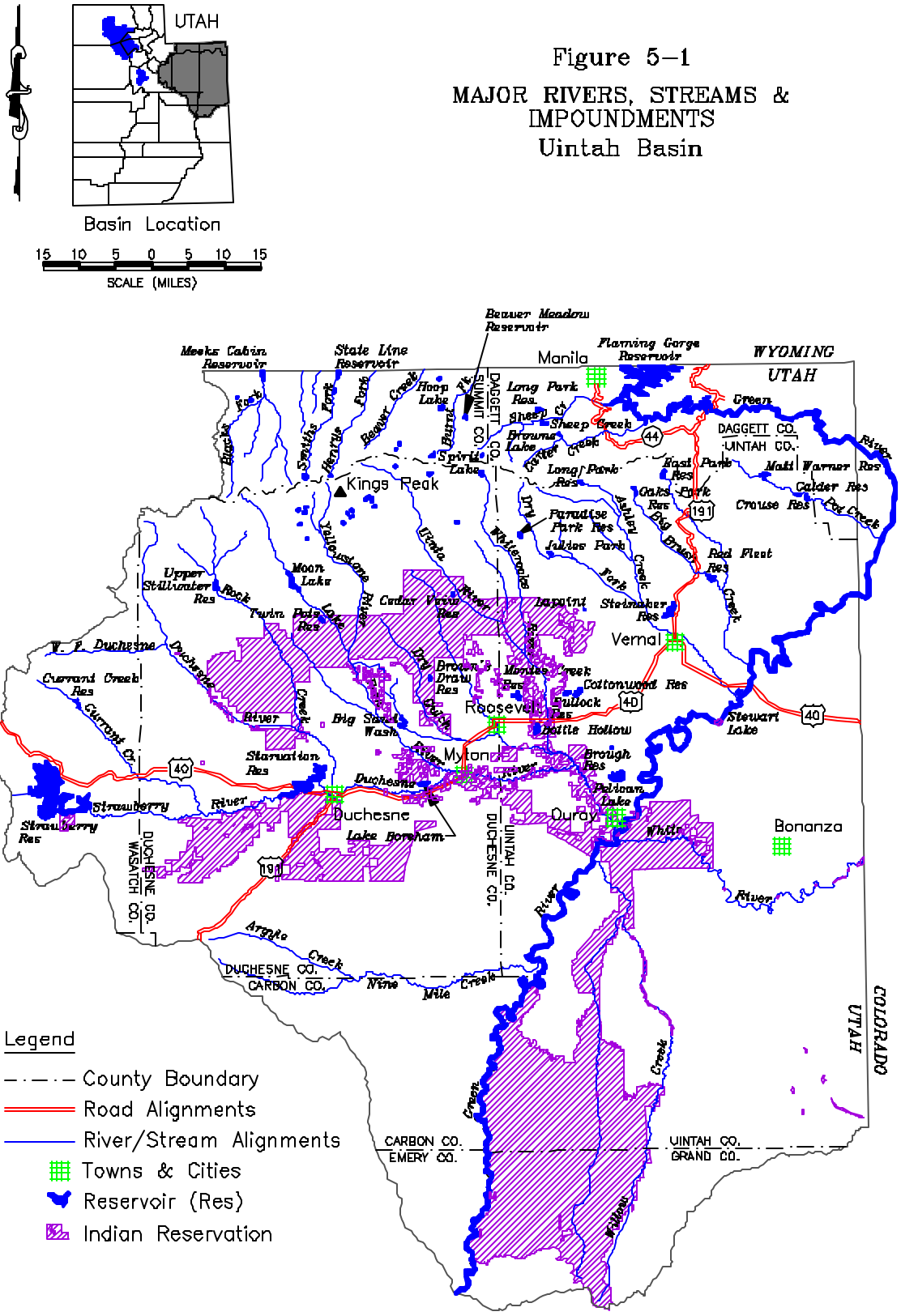
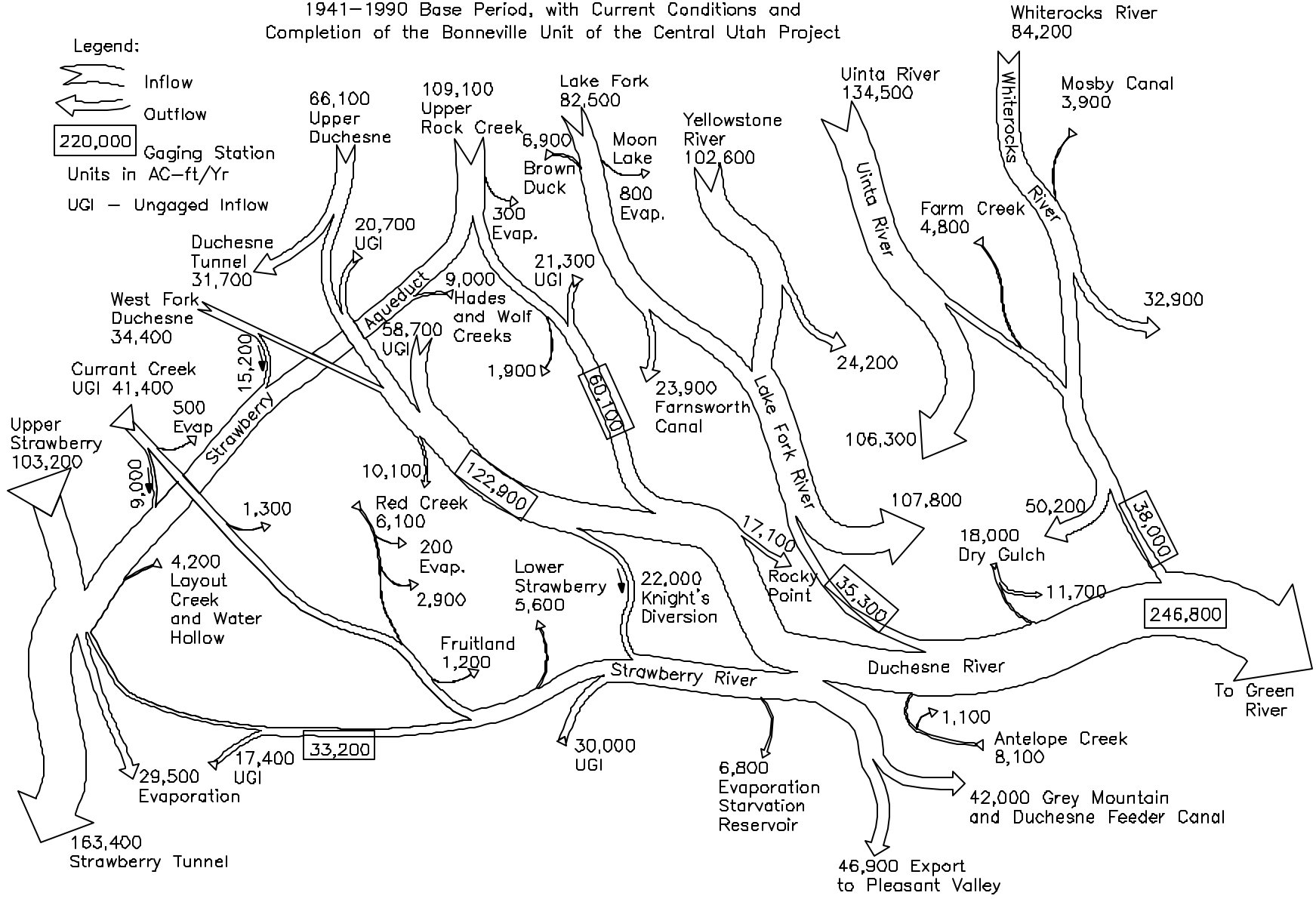

UTAH
Basin Location
15 10 5 0 5 10 15
SCALE (MILES)
Figure 5-1
MAJOR RIVERS, STREAMS & IMPOUNDMENTS
Uintah Basin
Beaver Meadow Reservoir
Meeks Cabin Reservoir
State Line Reservoir
Manila
Flaming Gorge Reservoir
WYOMING
UTAH
Kings Peak
DAGGETT CO.
UINTAH CO.
SUMMIT CO.
Vernal
Roosevelt
Myton
Duchesne
Duray
Bonanza
DUCHESNE CO.
WASATCH CO.
CARBON CO.
EMERY CO.
GRAND CO.
COLORADO
Legend
County Boundary
Road Alignments
River/Stream Alignments
Towns & Cities
Reservoir (Res)
Indian Reservation

Figure 5–2
Duchesne River System
Average Annual Streamflow and Stream Depletion Chart
1941–1990 Base Period, with Current Conditions and
Completion of the Bonneville Unit of the Central Utah Project



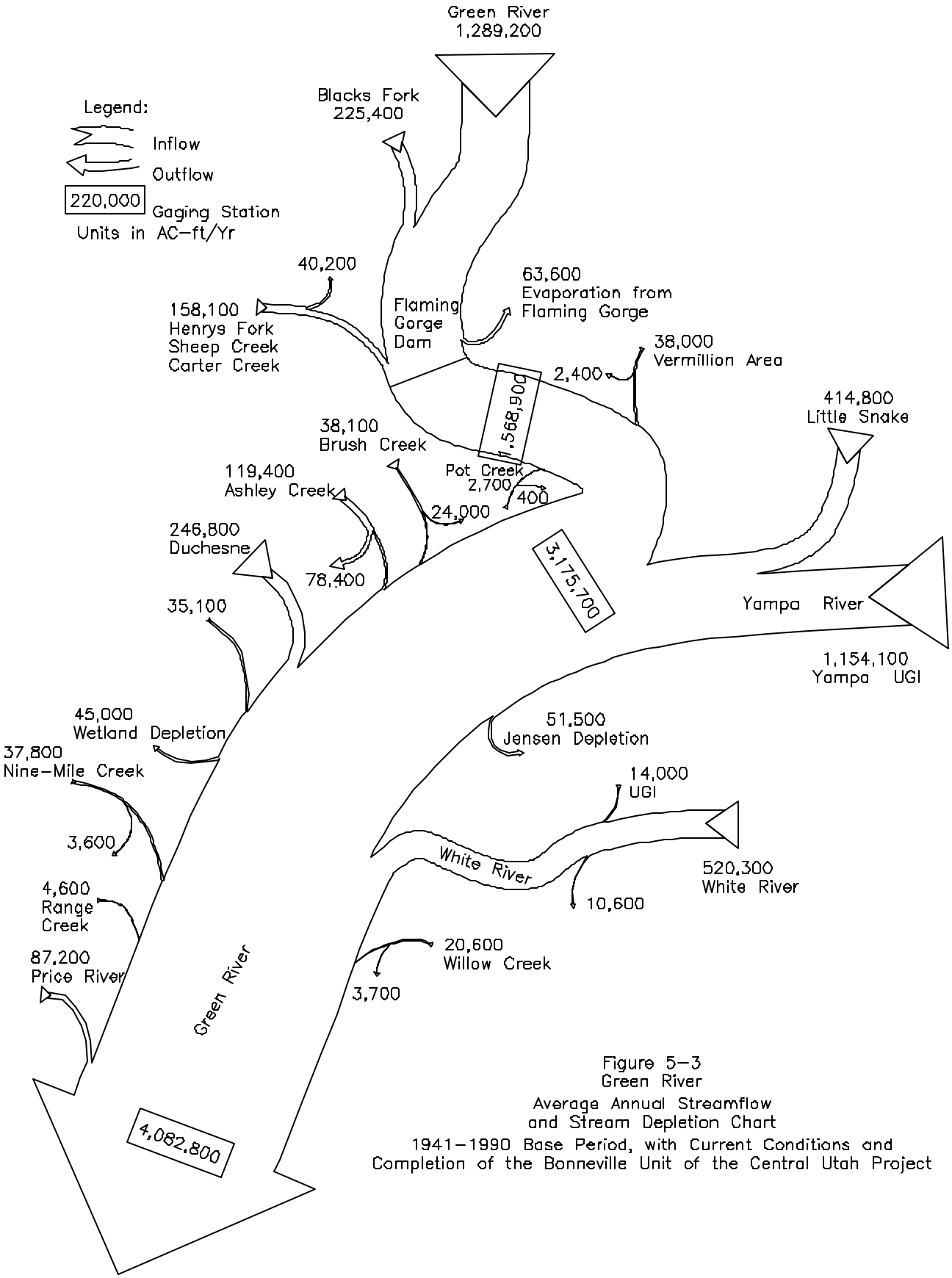


Figure 5-3
Green River
Average Annual Streamflow
and Stream Depletion Chart
1941-1990 Base Period, with Current Conditions and
Completion of the Bonneville Unit of the Central Utah Project

Gorge Reservoir, constructed by the Bureau of Reclamation, provides water storage, power generation and recreation. Strawberry, Starvation, Currant Creek, Upper Stillwater, Steinaker, Bottle Hollow and Red Fleet reservoirs are Central Utah Project (CUP) reservoirs that provide storage for municipal, industrial, agricultural and recreational water uses.

Municipal and industrial (M&I) water for the Bonneville Unit of the CUP is exported to the Wasatch Front from Strawberry Reservoir through the Syar Tunnel. It is released to Utah Lake and exchanged to Jordanelle Reservoir for use in northern Utah County and Salt Lake County.

Strawberry Valley Project water from Strawberry Reservoir is used for irrigation in southern Utah County. The Provo River Project exports water from the Duchesne River drainage to the Provo River through the Duchesne Tunnel. This water is stored in Deer Creek Reservoir for use in Utah and Salt Lake counties.

Developed water supply in the Uintah Basin is 811,380 acre-feet per year. Table 5-2 shows presently developed water supplies by sub-unit. Bonneville Unit water (101,900 acre-feet), which is part of the 811,380 acre-feet, will be exported to the Wasatch Front through the transbasin diversion Syar Tunnel which diverts from the Strawberry Reservoir.

Major Springs[61] - Many of the major springs are connected to surface flow by a karst system of underground tunnels, which includes the sinks on Ashley and Brush creeks. Water flows down the creek, disappears into a system of sink holes or caves, then reappears as large springs farther down the creek or in adjacent drainages. The large Ashley Spring on Ashley Creek is an example.

The lower valleys, such as Ashley Valley, contain relatively few springs and wells, almost all of which are of a low yield and used for domestic or stock supply purposes or irrigation of small garden tracts.

Further information on the basin's groundwater is found in Section 19 - Groundwater.

Cattle in the basin

5.3.2 Groundwater Supply[1,143,148,55]

Tributary groundwater inflow is a part of the total water supply. A 1970 hydrologic inventory of the Uintah study unit by the Utah Water Research Laboratory estimated about 8 to 16 percent of the total tributary inflow occurs as groundwater. The proportion varies from one area to another. About 35,000 acre-feet of groundwater originate on the south slope of the Uinta Mountains and 91,000 acre-feet on the north slope each year. The groundwater seeps into the streams through the alluvium and topsoil and may be used, and reused, as it drains to the Green River. Primary use of groundwater in this basin is for M&I use.

5.4 Water Use

Starvation Reservoir supplies 500 acre-feet per year of municipal and industrial water for the city of Duchesne.[89]

Steinaker Reservoir supplies about 1,600 acre-feet per year of municipal and industrial water to Vernal City, Ashley Valley and Maeser, along with water from Ashley Creek. Water is also pumped from Red Fleet Reservoir through a conveyance system to the water treatment plant in Vernal.

Most smaller cities obtain water from springs or creek diversions. Flaming Gorge Dam and Reservoir were completed in 1964, but only Dutch John

Table 5-1
Average Annual Streamflows at Gaging Stations

Gage No.	Station	Years of Record	Acre-Feet
9-2320	Sheep Creek near Manila[1]	1944-61	8,690[2]
9-2330	Carter Creek near Manila	1949-54	6,750
9-2340	Carter Creek at mouth near Manila	1947-55	110
9-2356	Pot Creek above diversion near Vernal	1958-90	2,800
9-2605	Jones Hole Creek near Jensen	1951-56	26,640
9-2615	Brush Creek above cave near Vernal[3]	1947-54	10,310[4]
9-2617	Big Brush Creek above Red Fleet Reservoir	1979-90	31,730
9-2620	Brush Creek near Vernal[3]	1940-65	24,470
9-2625	Little Brush Creek below East Park Res. near Vernal	1950-55	9,630
9-2630	Little Brush Creek near Vernal	1946-52	14,410
9-2640	Ashley Creek below Trout Creek near Vernal	1944-55	17,450
9-2645	South Fork Ashley Creek near Vernal	1944-55	14,410
9-2653	Ashley Creek above Red Pine Creek near Vernal	1965	70,530
9-2655	Ashley Cree above Springs near Vernal	1942-45	49,530
9-2665	Ashley Creek near Vernal[5]	1913-90	71,940
9-2680	Dry Fork above Sinks near Dry Fork	1940-65	25,850
9-2685	North Fork Dry Fork near Dry Fork	1947-65	4,410
9-2689	East Fork of Dry Fork above Sinks near Dry Fork[6]	1961-65	8,330
9-2690	East Fork of Dry Fork near Dry Fork	1947-63	5,770
9-2700	Dry Fork below Springs near Dry Fork	1942-65	20,780
9-2705	Dry Fork at mouth near Dry Fork	1955-65	15,420
9-2730	Duchesne River at Provo River Trail near Hanna	1945-54	41,340
9-2732	Duchesne River below Little Deer Creek near Hanna	1965	67,650[7]
9-2735	Hades Creek near Hanna	1950-65	6,400
9-2740	Duchesne River near Hanna	1922-60	56,472
9-2749	W. Fork Duchesne Riv. below Vat Diversion near Hanna	1989-90	6,700
9-2755	West Fork Duchesne River near Hanna	1923,46-90	36,150
9-2760	Wolf Creek at Rhodes Canyon near Hanna	1946-65	5,280
9-2780	South Fork Rock Creek near Hanna	1954-90	9,930

Table 5-1 (Continued)
Average Annual Streamflows at Gaging Stations

Gage No.	Station	Years of Record	Acre-Feet
9-2785	Rock Creek near Hanna	1950-65	110,000
9-2790	Rock Creek near Mountain Home	1938-90	126,800
9-2804	Hobble Creek at Daniels Summit near Wallsberry	1965	2,270
9-2855	Willow Creek near Soldier Summit	1944-47	3,870
9-2875	Water Hollow near Fruitland	1947-65	4,000
9-2815	Cottonwood Creek near Fruitland	1965	17,030
9-2889	Sowers Creek near Duchesne	1965	5,010
9-2895	Lake Fork above Moon Lake near Mountain Home	1934,43-55 1964-90	81,140
9-2900	Brown Duck Creek near Mountain Home	1934,43-55	6,830
9-2910	Lake Fork below Moon Lake near Mountain Home	1943-90	92,740
9-2915	Yellowstone Creek below Summit Creek near Altonah	1950-56	86,880
9-2925	Yellowstone Creek near Altonah	1945-90	100,700
9-2955	Uinta River below Gilbert Creek near Neola	1951-55	28,810
9-2960	Uinta R above Clover Creek near Neola	1946-55	102,800
9-2965	Clover Creek near Neola	1951-55	1,390
9-2980	Farm Creek near Whiterocks	1950-65	4,170
9-2985	Whiterocks River above Paradise Creek near Whiterocks	1946-55	71,170
9-2990	Paradise Creek near Whiterocks	1947-55	5,090
9-2995	Whiterocks River near Whiterocks	1900-90	88,390
9-3020	Duchesne River near Randlett	1942-90	423,800
9-3075	Willow Creek above diversion near Ouray	1951-65	13,180
9-3085	Minnie Maud Creek near Myton	1951-65	3,350

[1]Canal diversion to Sheep Creek.
[2]Since 1954 receives water from Carter Creek Canal.
[3]Oaks Park Canal diversion to Ashley.
[4]Adjusted to include flow in Oaks Park Canal.
[5]Contains water from Oaks Park Canal since 1941.
[6]Does not include flow diverted from Mosby Canal.
[7]Includes flow diverted through Duchesne Tunnel.

Source: USGS Daily Values by Earthinfo Inc. Westone - 1994

Table 5-2 Presently Developed Water Supplies	
Sub-Unit	Total Diversions
Upper Green	51,210
Ashley/Brush	88,840
Duchesne/Strawberry	543,760
Green	121,480
White	6,090
Total	811,380
Source: Water Budget Report for the Uintah Basin, Utah Division of Water Resources	

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receives municipal and industrial water from a filtration plant at the reservoir.

5.4.1 Agricultural Water Use

The largest use of surface water is for irrigation. Annual diversions have averaged about 797,610 acre-feet for approximately 201,120 acres. The total depletion of agricultural water is 411,310 acre-feet. Table 5-3 summarizes irrigation water use. Section 10 provides more detail.

5.4.2 Municipal and Industrial Water Use[57]

Municipal and industrial water diversions average about 13,770 acre-feet per year. This category includes water used in homes, businesses and industry. It also includes culinary water used to irrigate lawns and gardens, golf courses, parks, school yards and other outdoor areas. Industrial diversions, including power plants, have ranged up to 11,830 acre-feet per year. Table 5-4 shows the current usage.

5.4.3 Secondary Water Use

Water from secondary systems is used to irrigate lawns, gardens, parks, cemeteries and golf courses. These systems deliver untreated water and may be owned and operated by municipalities, irrigation companies, special service districts and others. Most cities have pipe systems serving a portion of their residents. Some have pressurized irrigation systems only on specific areas such as golf courses or large parks. Estimated diversions for 1996 are shown in Table 5-5.

5.4.4 Wet and Open Areas

Wet and open areas occur around Strawberry Reservoir and Stewart and Pelican lakes, Pariette Wetlands, along rivers, and near other streams, springs, bogs, wet meadows, lakes and ponds. Riparian lands display a great diversity of vegetation and wildlife species.

5.4.5 Minimum Instream Flows

Instream flows are primarily non-consumptive and contribute to the aquatic ecosystem and quality of life. The minimum instream flow for the lower Duchesne River is being negotiated by the federal and state wildlife services, the Bureau of Indian Affairs, Central Utah Water Conservancy District and the Ute Indian Tribe. The new Duchesne County Water Conservancy District expects to be part of the negotiations. The U.S. Fish and Wildlife Service is analyzing flows necessary to protect the endangered fish in this section of the Duchesne River. Figure 5-4 shows minimum instream flows for the Uintah Basin.

Table 5-3
Irrigation Water Use (1994)

Hydrologic Study Area	Area (acres)	Diversions[1] (acre-feet)	Depletions (acre-feet)
Upper Green	14,090	50,540	22,800
Ashley-Brush	22,510	82,570	57,700
Duchesne/Strawberry	143,040	537,100	287,940
Green	20,450	121,310	40,980
White	1,030	6,090	1,890
Total	201,120	797,610	411,310

[1]Some diversions consist of return flows from other diversions.
Source: Water Budget Report of the Uintah Basin, Utah Division of Water Resources

Table 5-4
1996 Municipal and Industrial Culinary Water Diversions (AC-FT/YR)

Description	County Daggett	Duchesne	Uintah	Total
Residential				
Public Community Systems	380	1,650	4,440	6,470
Public Non-Community Systems	0	10	10	20
Private Domestic Systems	20	560	300	880
Total	400	2,220	4,750	7,370
Commercial/Institutional				
Public Community Systems	100	580	1500	2,180
Public Non-Community Systems	10	20	20	50
Total	110	600	1,520	2,230
Industrial				
Public Community Systems	10	690	320	1,020
Self-Supplied Industries	0	40	3,770	3,810
Coal-Fired Power Plant (Deseret)	0	0	7,000	7,000
Total	10	730	11,090	11,830
Total Municipal & Industrial Diversions	520	3,550	17,360	21,430

Table 5-5 1996 Estimated Secondary Water Use[a] (ac-ft)	
County	Diversions
Daggett	70
Duchesne	1,050
Uintah	1,380
Total	2,500
[a]Does not include industrial use.	

5.4.6 Other Use

A major non-consumptive use of water in the Uintah Basin is recreation. State parks are located at Red Fleet, Starvation and Steinaker reservoirs. Flaming Gorge Reservoir is managed by the USDA Forest Service as part of the Flaming Gorge National Recreation Area. Other sites managed by the Forest Service are at Strawberry, Currant Creek and Upper Stillwater reservoirs. Boating, waterskiing, fishing and camping opportunities draw thousands of visitors annually. This aspect of water use is explained in detail in Section 15.

Hydroelectric power generation also uses basin water. Four hydro-generating power plants have a collective installed capacity of 149,950 kw -- Flaming Gorge Reservoir has 145,850 kw, and the small Uinta, Yellowstone and Sand Wash power plants have a total of 4,100 kw. Deseret Generation and Transmission Cooperative (DG&T), which operates a coal-fired plant, has a generating capacity of 450 megawatts. Section 18 provides additional information on hydropower and coal-fired generated power.

5.5 Interbasin Diversions

Water is exported from this basin west to the Bonneville Basin through the Duchesne Tunnel, the Daniels Creek diversion and the Syar (Strawberry) Tunnel.

5.5.1 Imports

About 1,350 acre-feet of water annually are imported into the North Fork of the Ashley Creek drainage from the north slope of the Uinta Mountains (Leidy Peak).

5.5.2 Exports and Outflow

The major interbasin diversions for the Uintah Basin are shown by Figure 5-5. In the spring of 1882, water was diverted from the upper tributaries of the Strawberry River to Daniels Canyon in Wasatch County through three small canals. Not enough water was available to increase this diversion by gravity flow, so a 1,000-foot tunnel was excavated through the mountain. This allowed additional water to be diverted from the Strawberry River drainage to Daniels Canyon.

The Strawberry Valley Project diverts water from the Uinta Basin into the Bonneville Basin and is one of the earliest federal reclamation projects. Water was collected in the 270,000 acre-foot active capacity Strawberry Reservoir formed by a dam on the Strawberry River, a tributary of the Duchesne River. Feeder canals brought additional water to the reservoir from Indian and Currant creeks. The Strawberry Tunnel, which is 3.7 miles long, extends from Strawberry Reservoir to Sixth Water Creek. Sixth Water Creek is tributary to Diamond Fork, which empties into the Spanish Fork River. Historically, 61,500 acre-feet annually have been delivered through the Strawberry Tunnel to the Spanish Fork River and used for irrigation in the southern portion of Utah Valley. When the Bonneville Unit of the Central Utah Project is in full operation, annual exports from Strawberry Reservoir will increase to 163,400 acre-feet. Table 5-6 shows the major exports from the Uintah Basin.

The Duchesne Tunnel, part of the Provo River Project, diverts an average of 31,700 acre-feet of water from the North Fork of the Duchesne River, a tributary of the Green and Colorado rivers. The tunnel begins in the North Fork of the Duchesne River 21 miles due east of Kamas and extends six miles under a spur of the Uinta Mountains. It then discharges into the main stem of the Provo River upstream from Kamas. The Duchesne Tunnel was completed in 1953 and began delivering water for

the irrigation season of 1954. Its capacity is 600 cfs and is dependent upon rights to surplus water for its diversions. More than 70 percent of the annual flow of the North Fork occurs during May, June and July. ❑

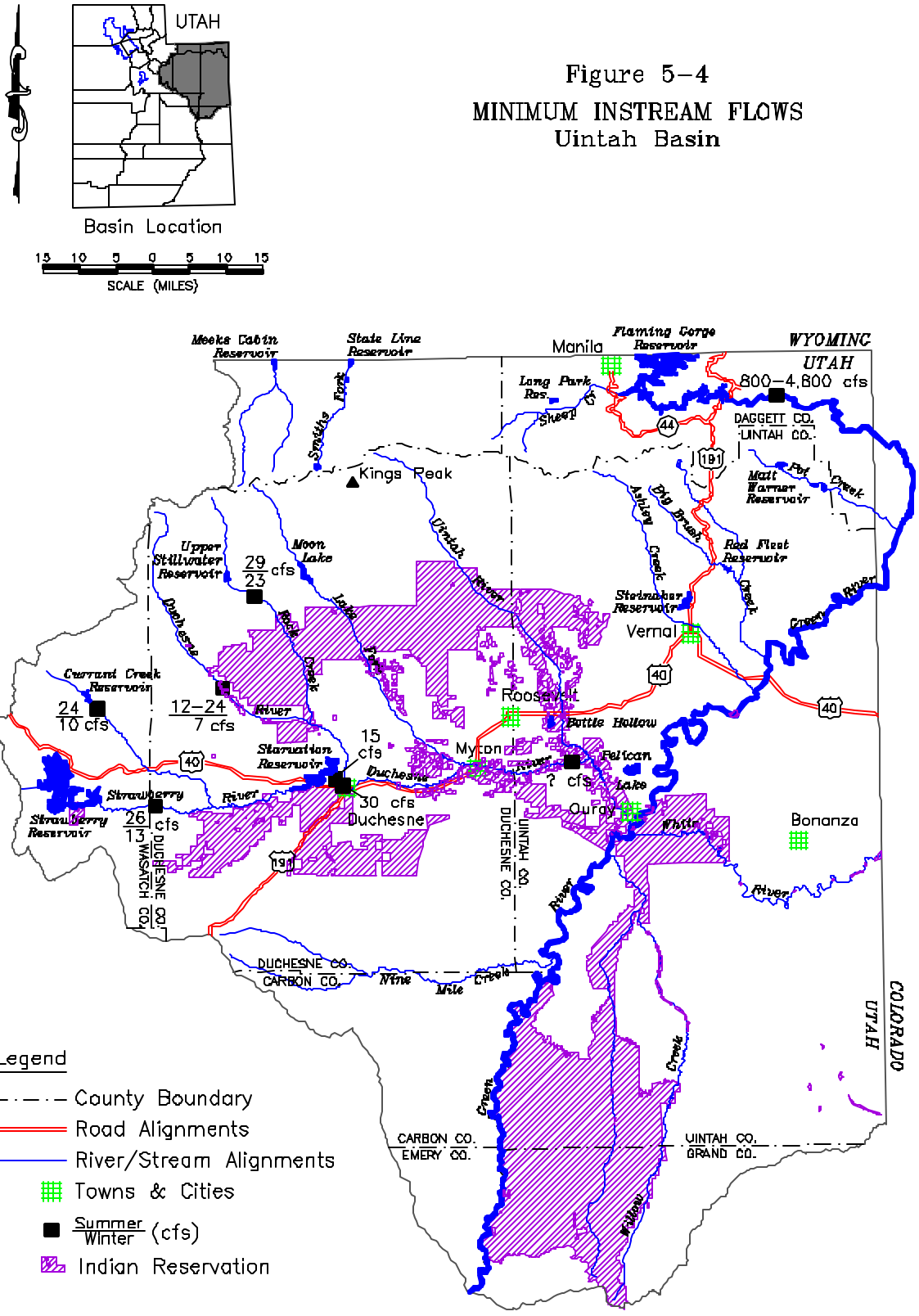


Figure 5–4
MINIMUM INSTREAM FLOWS
Uintah Basin

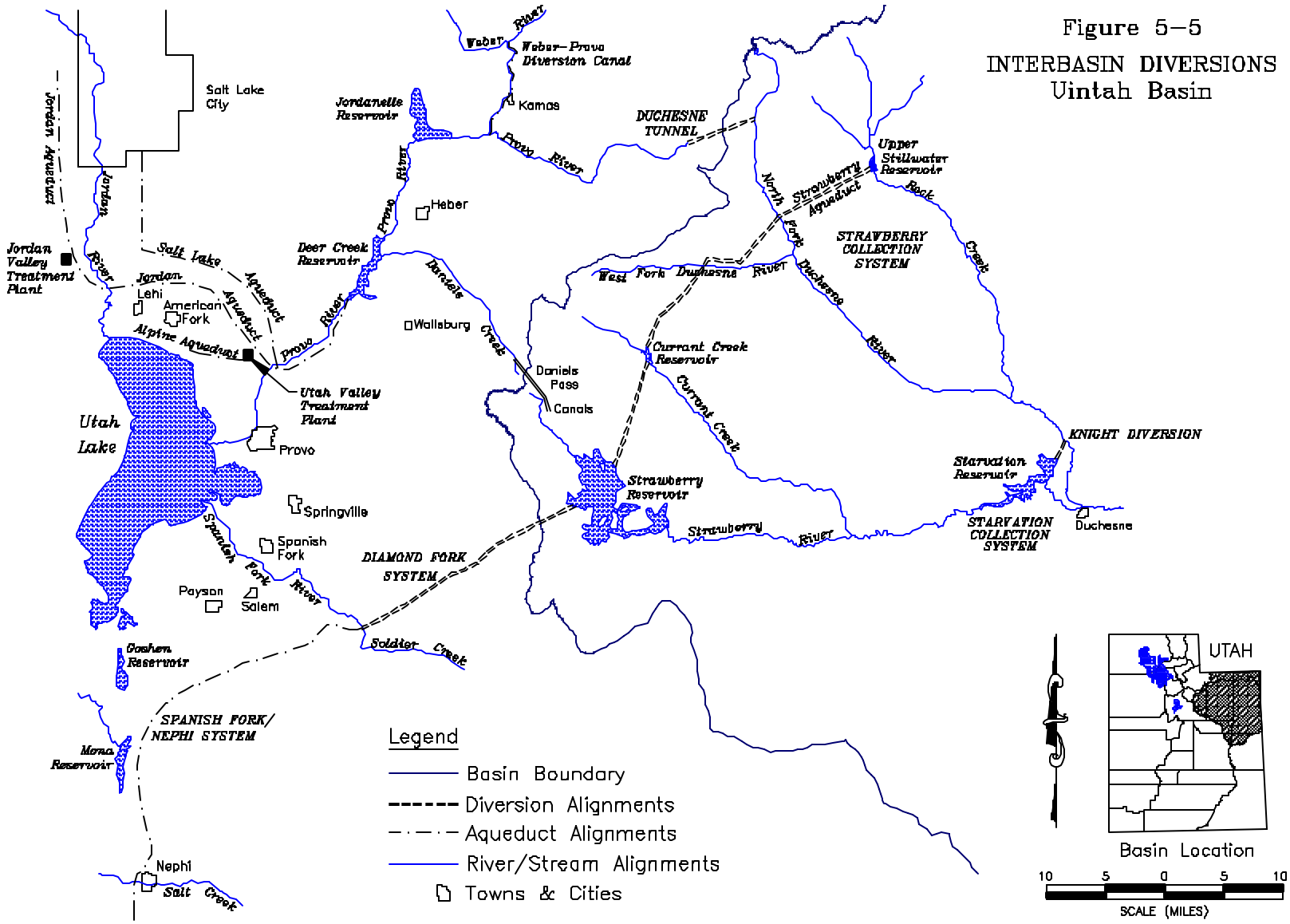


Figure 5–5

INTERBASIN DIVERSIONS
Uintah Basin

Table 5-6
Interbasin Diversions

Source Basin	Source/Stream	Conveyance	Receiving Stream/Facility	Operator	Flow Capacity (cfs)	Average Annual Depletion (ac-ft)
Exports						
Uinta	Strawberry River	Strawberry/Willow Cr. Canal, Hobble Creek Ditch	Daniels Creek	Daniels Irrigation Co.	30/12	2,900[a]
Uinta	Strawberry River	Strawberry Tunnel	Sixth Water (Diamond Fork) Spanish Fork	Strawberry Water Users Assoc.	460	61,500
Uinta	Duchesne Tributaries	Strawberry Collection System	Diamond Fork	CUWCD	600	101,900[b]
Uinta	Duchesne River (North Fork)	Duchesne Tunnel	Provo River	Provo River Water Users Assoc.	600	31,700
	Reservoir Evaporation					30,300[c]
Total						228,300
Imports						
Lucerne	North Slope Uinta Mtns. (Leidy Peak)	Two canals	North Fork Ashley Creek	Highline Irrigation Co.	50	1,350

[a]The diversion will end when the Wasatch County Water Efficiency Project/Daniels Replacement Pipeline (WCWEP/DRP) is completed.
[b]Total potential diversion when CUP is completed and demand requires.
[c]Evaporation from reservoir surfaces.

Contents

Section 6

Uintah Basin Plan

Utah State Water Plan

Management

The Uintah Basin provides a variety of water-related issues which can be viewed in isolation or as part of a broader mosaic of ecosystem management.

6.1 Introduction

This section describes the water management functions of private and government entities. Water management enables delivery of water to people and places at the optimum time and in the optimum condition. One of the present challenges facing water managers in the Uintah Basin is delivering water for irrigation during dry years or in areas where no reservoir storage is available for spring runoff impoundment for late summer delivery to water users.

6.2 Setting

Water management has historically been the responsibility of local water suppliers such as mutual irrigation companies, water user associations, special districts and cities. These entities operate within the rules and guidelines established by state statutes and administered by the State Engineer. Since the mid-1800s, most basin water has been locally used for agricultural crops.

6.3 Management Entities and Systems

Water management organizations in the Uintah Basin include the large multi-county CUWCD with extensive facilities in the basin. The Uintah Water Conservancy District serves Uintah County and is responsible for managing Steinaker and Red Fleet reservoirs. The Duchesne County Water Conservancy District serves all of Duchesne County. The Provo River Water Users Association is responsible for operation and maintenance of the Duchesne Tunnel. In addition, other mutual irrigation companies may control from only a few acre-feet to several thousand acre-feet of annual water rights.

The Bureau of Indian Affairs (BIA) manages all irrigation water on the reservation,[137] both Indian and non-Indian. Water is allocated according to water rights associated with the irrigated land, and Indian water rights have first priority. Ditch riders, hired by the BIA, check the water diverted to each farm. There are about 59,300 acres of irrigated Indian lands. The Uintah Indian Irrigation Project (UIIP), managed by the BIA, delivers water to UIIP lands owned by the tribe, individual Indians and non-Indians. All Indian irrigation water rights are held in trust by the BIA.

Domestic and culinary water are administered and controlled by the Ute Indian Tribe. Non-Indian domestic water is controlled by entities such as Roosevelt City and other non-Indian communities located within the reservation boundaries. The Moon Lake Water Users Association controls 88,070 acre-feet of water from the Lake Fork, Yellowstone and Uinta rivers.

The primary tools for managing water in the basin are storage reservoirs. Table 6-1 and Figure 6-1 show existing lakes and reservoirs in the drainage area greater than 100 acre-feet in volume.

6.3.1 Agricultural

Management of agricultural water is provided by numerous mutual irrigation companies and water conservancy districts. Table 6-2 shows irrigation companies and water user groups with management responsibilities in delivering water to land areas larger than 350 acres. The four major water management entities delivering federal reclamation project water are: 1) Strawberry Water Users Association for the Strawberry Valley Project,

2) Ute Indian Bureau of Indian Affairs (BIA), 3) Uintah Water Conservancy District for Uintah County, and 4) Central Utah Water Conservancy District for the Central Utah Project. The newly formed Duchesne County Water Conservancy District for Duchesne County does not deliver any federal reclamation project water.

These organizations provide water for irrigation and M&I. More information on agricultural water management can be found in Section 10.

6.3.2 Municipal and Industrial

A large proportion of municipal and industrial (M&I) water is managed by cities and agencies such as public works departments. The Ute Indian Tribe manages its own culinary water system and delivers some water to other entities. Figure 6-2 shows the location of public community water suppliers. More data on public and private water suppliers can be found in Sections 5 and 11.

6.3.3 Wholesalers/Water Suppliers

Wholesalers are those agencies that deliver raw or treated water to other agencies for the resale to water users. The Central Utah Water Conservancy District and the Uintah Water Conservancy District are the primary water wholesalers in the Uintah Basin. Municipal water districts are associated with specific cities to deliver raw or treated water which is then sold at a higher price to residential, commercial and industrial users. Table 6-3 lists wholesale water suppliers.

6.3.4 Waterfowl Management

Utah Division of Wildlife Resources manages Stewart Lake and Pelican Lake. Jones Hole and Ouray National Waterfowl Refuge are managed by the U. S. Fish and Wildlife Service (FWS). For more information on waterfowl and wildlife-related water management, see Section 14.

6.4 Problems and Needs

With completion of the Central Utah Project, most of the large dam and reservoir sites will have been developed. Future growth may result in smaller dam sites being considered for construction on tributaries and in the diversion of Green River water for use in the basin.

Following the large water project development period, long-range planning will become more crucial. Public involvement and collaboration among competing water interests will be required. There is a growing need for education programs to prepare present and future leaders to make informed choices about how water is managed. Tradeoffs between economic and environmental values can best be made by people who understand the nature of water and the role it plays in natural ecosystems and in economic growth. ❑

Table 6-1
Existing Lakes and Reservoirs[a]

Name	County	Owner	Storage (ac-ft)	Use
Bridger Lake	Summit	Smith's Fork IC	3,273	IR,RE
Meeks Cabin Lake	Summit	BR	32,470	IR,RE
Beaver Meadows Reservoir	Summit	BR	2,155	IR,RE
Stateline Reservoir	Summit	BR	14,000	IR,RE
Tamarack Lake	Summit	Sheep Creek IC	600	IR,RE
Hoop Lake	Summit	Hoop Lake IC	5,340	IR,RE
China Lake	Summit	Smith's Fork IC	621	RE
Crouse Lake	Uintah	Wildlife Resources	1,100	IR,RE
Calder Lake	Uintah	Wildlife Resources	1,630	RE
Matt Warner Reservoir	Uintah	Wildlife Resources	2,796	RE
East Park Reservoir	Uintah	Wildlife Resources	3,774	IR,RE
Oaks Park Reservoir	Uintah	Ashley Valley IC	6,727	IR,RE
Goose Lake	Uintah	Ashley Valley IC	150	IR
Long Park (Uintah) Reservoir	Uintah	Ashley Valley IC	531	IR,RE
Paradise Park Reservoir	Uintah	BR/Whiterocks IC	3,135	IR,RE
Whiterocks Lake	Uintah	Ouray Park	1,075	IR,RE
Cliff Lake	Uintah	Ouray Park	1,063	IR,RE
Red Fleet Reservoir	Uintah	BR	26,170	WS,IR,RE,M&I,FC
Steinaker Reservoir	Uintah	BR/CUP	33,300	WS,IR,RE,M&I,FC
Stewart Lake	Uintah	Wildlife Resources	300	RE
Pelican Lake	Uintah	Ouray Park IC	12,000	IR,RE
Brough Reservoir	Uintah	Ouray Park IC/ Wildlife Resources	3,000	IR,RE
Cottonwood Reservoir	Uintah	Ouray Park IC	6,130	IR,RE
Bullock Draw Reservoir	Uintah	Wildlife Resources	560	IR,RE
LaPoint Reservoir	Uintah	Whiterocks IC	1,520	IR,RE
Julius Park Reservoir	Uintah	Mosby IC	240	IR,RE
Ashley Valley Wastewater	Uintah	Ashley Valley Sewer Board	2,350	M&I
Pariette Control Dike	Uintah	Wildlife Resources	200	RE
Bonanza Power (Recycle Pond)	Uintah	Deseret G & T	220	M&I
Pariette West Dike	Uintah	Wildlife Resources	250	RE
Goose Lake (Upper)	Uintah	Ashley valley IC	340	IR,RE
Toware Lake	Uintah	BIA	350	IR,RE
Twin Lakes	Uintah	Ashley Valley IC	500	IR,RE
Ashley Twin Lakes	Uintah	Ashley Valley IC	360	IR,RE
Bonanza Power (Raw Water Pond)	Uintah	Deseret G & T	500	M&I

Table 6-1 (Continued)
Existing Lakes and Reservoirs[a]

Name	County	Owner	Storage (ac-ft)	Use
Bonanza Power (S Evap Pond)	Uintah	Deseret G & T	520	IR,RE
Pariette Dike	Uintah	Wildlife Resources	820	RE
Bonanza Power (N Evap Pond)	Uintah	Bonanza Power	1,470	M&I
S. F. Phosphate Pond	Uintah	S. F. Simplot	16,000	M&I
Chepeta Lake	Duchesne	Whiterocks IC	2,812	IR,RE
Moccasin Lake	Duchesne	Whiterocks IC	122	IR,RE
Wigwam Lake	Duchesne	Whiterocks IC	110	IR,RE
Fox Lake	Duchesne	Dry Gulch IC	1,126	IR,RE
Cresant Lake	Duchesne	Dry Gulch IC	184	IR,RE
Atwood Lake	Duchesne	Dry Gulch IC	2,551	IR,RE
Upper Chain Lake	Duchesne	Dry Gulch IC	507	IR,RE
Lower Chain Lake	Duchesne	Dry Gulch IC	796	IR,RE
Water Lily Lake	Duchesne	Moon Lake WUA	Not Used	RE
East Timothy Lake	Duchesne	Moon Lake WUA	616	IR,RE
West Timothy Lake	Duchesne	Moon Lake WUA	Not Used	RE
Farmers Lake	Duchesne	Moon Lake WUA	Not Used	RE
White Miller Lake	Duchesne	Moon Lake WUA	Not Used	RE
Deer Lake	Duchesne	Moon Lake WUA	120	IR,RE
Milk Lake	Duchesne	Hartman Family	492	IR,RE
Superior Lake	Duchesne	Moon Lake WUA	318	IR,RE
Five Point Lake	Duchesne	Moon Lake WUA	639	IR,RE
Drift Lake	Duchesne	Moon Lake WUA	170	IR,RE
Bluebell Lake	Duchesne	Moon Lake WUA	257	IR,RE
Brown Duck Lake	Duchesne	Moon Lake WUA	321	IR,RE
Island Lake	Duchesne	Moon Lake WUA	688	IR,RE
Kidney Lake	Duchesne	Moon Lake WUA	3,910	IR,RE
Clement Lake	Duchesne	Moon Lake WUA	630	IR,RE
Cedar View Reservoir	Duchesne	BIA	200	IR,RE
Twin Pots Reservoir	Duchesne	Moon Lake WUA	4,130	IR,RE
Upper Stillwater Reservoir	Duchesne	BR/CUP	32,009	FC,IR,RE
Currant Creek Reservoir	Duchesne	BR/CUP	15,670	FC,IR,RE
Starvation Reservoir	Duchesne	BR/CUP	167,500	FC,IR,M&I,RE
Strawberry Reservoir	Duchesne	BR/CUP	1,106,500	FC,IR,M&I,RE
Bottle Hollow Reservoir	Duchesne	BIA	11,100	RE
Moon Lake Reservoir	Duchesne	Moon Lake WUA	35,760	IR,RE
Lake Boreham Reservoir	Duchesne	BIA	5,800	IR,RE

Table 6-1 (Continued)
Existing Lakes and Reservoirs[a]

Name	County	Owner	Storage (ac-ft)	Use
Red Creek Reservoir	Duchesne	Red Creek IC/ Wildlife Resources	5,700	IR,RE
Big Sand Wash Reservoir	Duchesne	Moon Lake WUA	12,100	IR,RE
Brown Draw Reservoir	Duchesne	Moon Lake WUA	5,900	RE
Heller Lake	Duchesne	Monarch IC	180	IR
Montez Creek Reservoir	Duchesne	Dry Gulch IC	1,520	IR,RE
Daggett Lake	Daggett	Lucerne Valley Canal Co.	330	IR,RE
Spirit Lake	Daggett	Sheep Creek IC	550	IR,RE
Browns Park National Wildlife Refuge Pond	Daggett	BLM	400	IR,RE
Browne Lake	Daggett	Wildlife Resources	640	RE
Sheep Creek Reservoir	Daggett	Wildlife Resources	920	RE
Long Park (Daggett) Res.	Daggett	Sheep Creek IC	13,700	IR,RE
Flaming Gorge Reservoir	Daggett	BR	3,789,000	P,IR,FC,RE

[a]Lakes and reservoirs larger than 100 acre-feet of storage.

Key to Use Categories:
FC - Flood Control
IR - Irrigation
M&I - Municipal/Industrial
P - Power Generation
RE - Recreation

Key to Owners:
BLM - Bureau of Land Management
BR - U.S. Bureau of Reclamation
CUP - Central Utah Project
IC - Irrigation Company
WUA - Water Users Association

Figure 6-1

EXISTING MAJOR LAKES AND RESERVOIRS
Uintah Basin

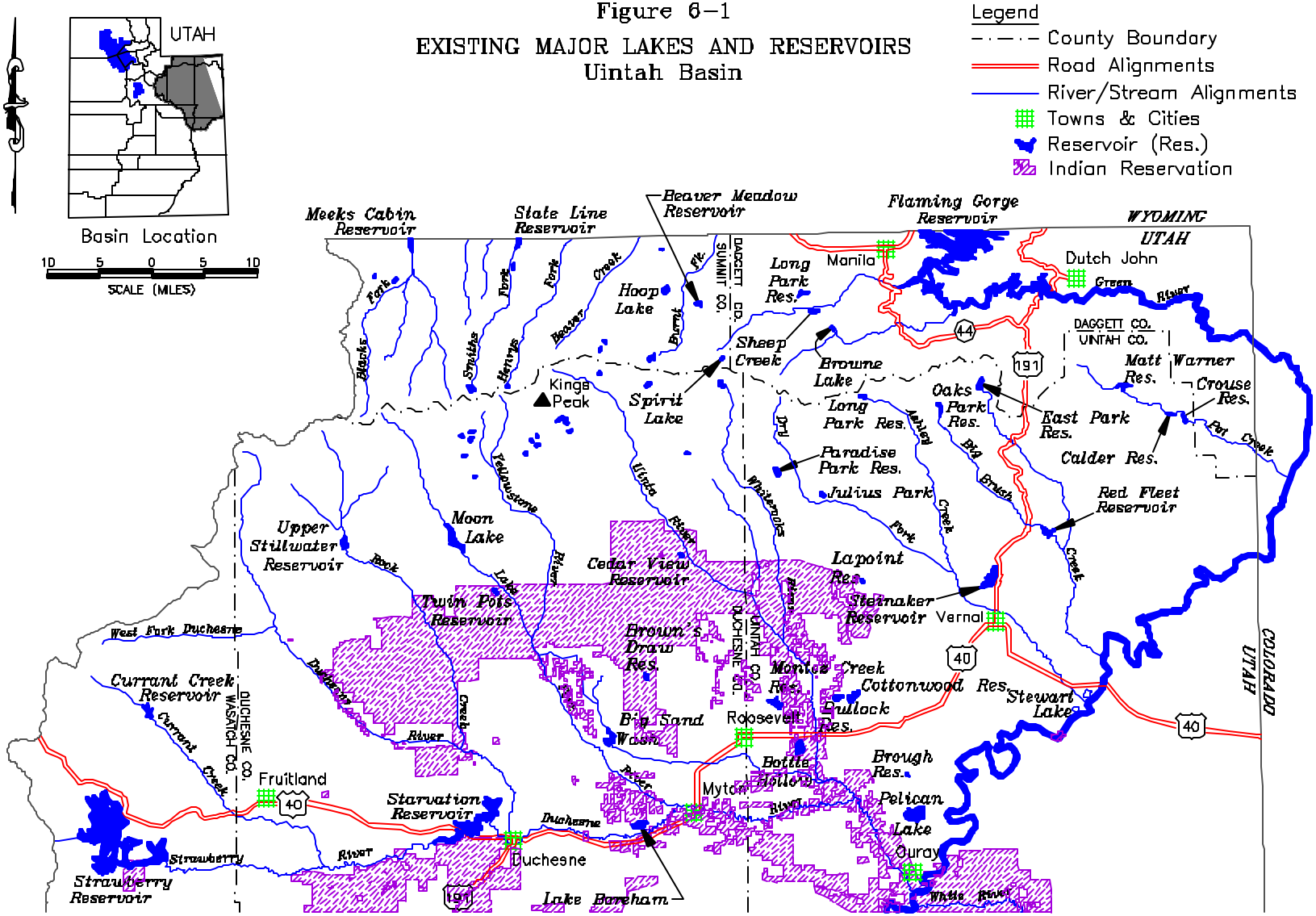


Table 6-2
Major Irrigation Water Provider Organizations

Organization	Acres Served	Water Source
Pioneer Canal Company	1,405	Duchesne River
Tabby Irrigation Company	1,255	Duchesne/Strawberry
Rhoades Canal	1,003	Duchesne River
Riverdell Canal Company	507	Duchesne River
Tabby Irrigation Company	1,047	Duchesne River
Duchesne Irrigation Company	1,854	Duchesne River
Hicken Ditch	429	Duchesne River
Hidden Valley Irrigation Co.	540	Duchesne River
Farm Creek Irrigation Company	1,606	Duchesne River
Rocky Point Ditch Company	3,556	Duchesne River
Uintah Basin Irrigation Company	10,304	Duchesne River
Monarch	494	Dry Gulch Creek
Orchard Mesa	596	Duchesne River
Little Red Creek	392	Duchesne River
Red Creek Irrigation Company	2,770	Red Creek
U.S. Fish & Wildlife Service	566	Duchesne River
Uintah Indian Irrigation Service	77,500	Uinta/Lake Fork/Duchesne
Ronald Ivie	528	Duchesne River
JJNP Company	754	Duchesne/Strawberry
Uintah Independent Company	2,585	Uinta River
Dry Gulch Irrigation Company	30,194	Lake Fork River
Dry Gulch Irrigation Company	20,894	Uinta River
Farnsworth Canal & Reservoir Co.	11,600	Lake Fork River
Lake Fork Western Irrigation Co.	2,309	Lake Fork River
Lake Fork Irrigation Company	2,440	Lake Fork River
Uteland Ditch Company	1,368	Lake Fork River
South Boneta Ditch Company	617	Lake Fork River
T. N. Dodd Ditch Company	990	Uinta River
Sandwash Irrigation Company	655	Sandwash Creek
Uintah River Irrigation Company	2,044	Uinta River
Ouray Park Irrigation Company	5,000	Deep Creek, Uinta River
Whiterocks Irrigation Company	4,360	Whiterocks River
Ashley Upper Irrigation Company	8,820	Ashley/Spring Creek

Table 6-2 (Continued)
Major Irrigation Water Provider Organizations

Organization	Acres Served	Water Source
Island Ditch	690	Ashley Creek
Rock Point Irrigation Company	2,940	Ashley Creek
Sunshine Canal	1,000	Brush Creek
Burton Ditch	559	Brush Creek
Burns Bench Canal	3,360	Brush Creek
Escalante Ranch	2,600	Green River
High Line Canal Company	1,250	Ashley Creek
River Irrigation Company	420	Ashley Creek
Greendale Water Company	257	Allen Creek
Interstate Irrigation Company	34	Burnt Creek
Peoples Canal Company	349	Spring Stream
Sheep Creek Irrigation Company	8,109[a]	Sheep/Carter Creek
Pot Creek Irrigation Company	164	Crouse/Pot Creek

[a]About 200 acres located in Wyoming.
Source: *Water-Related Land Use Inventories*, Division of Water Resources, May 1994.
Water Companies of Utah, Division of Water Rights, May 1990.

Figure 6-2
PUBLIC COMMUNITY WATER PROVIDERS
Uintah Basin

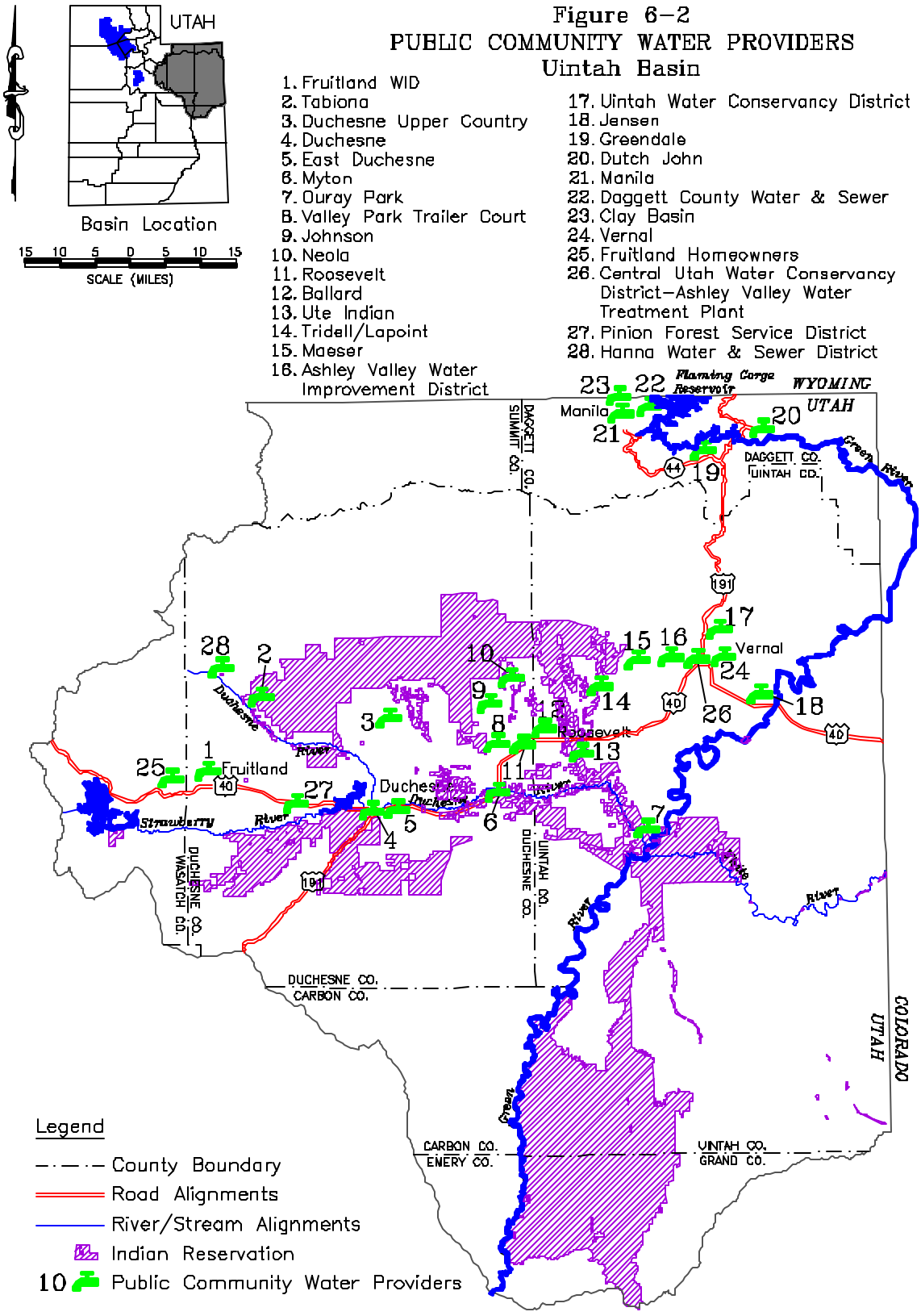


Table 6-3
Water Wholesalers/Water Suppliers

Conservancy Districts

Central Utah Water Conservancy District

Duchesne County Water Conservancy District

Uintah Water Conservancy District

Municipal Water Suppliers

Daggett County
Bureau of Reclamation (Dutch John)
Daggett County Water and Sewer
Greendale Water Company
Manila Municipal Water System
Questar Pipeline Company (Clay Basin)

Duchesne County
Central Utah Water Conservancy District - Duchesne Plant
Duchesne City
Myton Municipal Water System
Johnson Water Improvement District
East Duchesne Water Improvement District
Duchesne County Upper Country WID
Fruitland Water Special Service District
Roosevelt Municipal Water Systems
Neola Water and Sewer District
Tabiona Town
Valley Park Trailer Court
Ute Indian Tribe Water System
Fruitland Homeowners Association
Hanna Water and Sewer District

Uintah County
Uintah Highlands Water and Sewer Improvement District
Uintah Special Service District
Ashley Valley Water and Sewer Improvement District
Jensen Water Improvement District
Maeser Water Improvement District
Central Utah Water Conservancy District - Ashley Plant
Vernal Municipal Water System
Utah Water Conservancy District
Tridell-LaPoint Water Improvement District
Ute Indian Tribe Water System
Ballard Water Improvement District
Ouray Park Water Improvement District
Johnson Water District

Source: Utah League of Cities & Towns, *Directory of Local Government Officials*, Salt Lake City, Utah, 1997.

Contents

Section 7
Uintah Basin Plan

Utah State Water Plan
Regulation/Institutional Considerations

The regulation of water resources is necessary to manage conflicts and to provide orderly future planning and development.

7.1 Introduction

This section discusses federal and state regulations to protect and manage water resources in the Uintah Basin. It also discusses some environmental concerns.

Local, state and federal governments have formalized the institutional arrangements we now have by passing laws. Laws create government agencies empowered with the authority and responsibility to carry out specific missions. The mission of Utah's water agencies is to provide orderly water rights administration, adequate supplies of good quality water, and a quality environment to meet the needs of its people.

7.2 Setting

In the Department of Natural Resources, the Division of Water Rights (also known as the State Engineer's Office) is responsible for water allocation, distribution, dam safety and stream alteration. The Division of Water Resources regulates the cloud seeding program, is responsible for state water planning, and manages three water development funding programs. Two divisions within the Department of Environmental Quality, the Division of Drinking Water and the Division of Water Quality, bear the major responsibility for water quality. The *State Water Plan* (1990), Sections 7, 9, 11 and 12, explains these state agencies' statutory functions.

Federal agencies are also part of the regulatory picture (see Section 16). The U.S. Fish and Wildlife Service has a prominent role in protecting the threatened or endangered species and managing the Ouray National Waterfowl Refuge. The Environmental Protection Agency and the Army Corps of Engineers also have a significant role in protecting water quality and wetlands.

River commissioners regulate the use of water at the local level. Water masters and ditch riders operate the systems of irrigation waters. Cities, towns, districts, water associations, and the Uintah and Ouray Ute Tribe operate the community systems.

7.2.1 Current Regulation

Water Rights - Water law is administered by the Division of Water Rights (State Engineer) and based on the doctrine of prior appropriation. The Division of Water Rights has a regional office in Vernal that carries out the day-to-day activities within the basin.

Utah water law allows changes in the point of diversion, place of use and/or nature of use of an existing right. To make any change, the water user must file a change application with the State Engineer who will approve or reject the application. The decision is strongly dependent upon whether the change will impair the water rights of others. Compensation can be made, or conflicting rights may be acquired to resolve problems.

Perfected and approved water rights are considered real property. Unapproved applications and stock in mutual water companies are considered personal property. As such, they can be bought and sold in the open market.

In the appropriation process, the State Engineer analyzes the available data and, when needed, conducts one or more public meetings to present findings and receive input before adopting a final

policy regarding future appropriation and administration of water within a given area.

Through regulatory authority, the State Engineer influences water management by establishing and/or regulating diversion limitations (duty of water, usually about 3.0 or 4.0 acre-feet per acre in the Uintah Basin) for various uses. The State Engineer also sets policies on water administration for surface water and groundwater supplies. It is the state law that the State Engineer can allow improved irrigation efficiency but not expansion of acreage.

The State Engineer is responsible for a number of functions. These include: 1) distribution of water in accordance with established rights, 2) adjudication of water rights under an order of a state district court, 3) approval of plans and specifications for construction of dams and inspection of existing structures for safety, 4) licensing and regulating the activities of water well drillers, 5) regulation of geothermal development, 6) authority to control streamflow and reservoir storage or releases during a flooding emergency, and 7) regulation of stream channel alteration activities.

Water Quality - The Utah Department of Environmental Quality, through the Division of Water Quality, is responsible for water quality regulation. Quality of a specific body of water is determined using a set of standards for allowable contaminant levels. The state's antidegradation policy says in part: "Waters whose existing quality is better than the established standards for the designated uses will be maintained at high quality unless it is decided by the board, after appropriate intergovernmental coordination and public participation, in concert with Utah's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located."

7.2.2 Agencies and Organizations

In the 20th century, with enactment of the federal reclamation law, the Bureau of Reclamation, Natural Resources Conservation Service, Rural Utilities Service, Army Corps of Engineers, U. S. Geological Survey, Environmental Protection Agency, and the U. S. Fish and Wildlife Service have all come to play major roles. Their roles have been to provide regulatory, technical and financial assistance to water users through state and local organizations. The organizations formed by specific enabling state legislation are described below.

Water Conservancy Districts - The State District Court establishes these districts in response to formal petitions. A board of directors, appointed by the relevant county commission, governs when the district consists of a single county. The governor appoints directors for multi-county districts.

Conservancy districts have very broad powers. These include constructing and operating water systems, levying taxes and contracting with governmental entities. Districts may include incorporated and unincorporated areas. Those located in the Uintah Basin are the Central Utah Water Conservancy District, the Uintah Water Conservancy District and the Duchesne County Water Conservancy District.

Special Service Districts - These districts have many of the same duties and authorities of other districts and can be created by either counties or municipalities. They can be established to provide water, sewer, drainage, flood control, as well as non-water related service. The basin has 17 special service districts. A more complete list of special service districts can be found in the *Directory of Local Government Officials*, published annually by the Utah League of Cities and Towns.

City Water Departments - Municipalities establish these to provide water service to residents.

Mutual Irrigation Companies - Mutual irrigation companies were responsible for most early water development in Utah. They are formed under the state corporation code, and the majority are nonprofit. Stockholders have the right to a quantity of water, and they are assessed for the expenses of their company operations according to the number of shares they individually own.

Private Water Companies - These are organized as for-profit and nonprofit corporations. The nonprofit companies are not regulated by the Public Service Commission and only need to provide service to shareholders.

Strawberry Reservoir

Duchesne County has more than 37 water organizations, including mutual and private water companies and water users associations. Uintah and Daggett counties have 33 and six, respectively. Wasatch, Summit and Carbon counties have no water organizations in the Uintah Basin study area.

7.3 Problems and Needs

Reservoirs in the Uintah Basin attract large crowds of flat-water recreationists, namely boaters, anglers, water skiers and campers. Pollution of the drinking water flowing from these reservoirs is an increasing problem. Overcrowding and associated safety issues, especially at Strawberry and Steinaker reservoirs, are also concerns.

Inclusion of the Colorado pikeminnow (formerly, the Colorado squawfish), humpback chub, bonytail chub and razorback sucker on the endangered species list by the U. S. Fish and Wildlife Service (USFWS) has necessitated close coordination with the USFWS and other resource agencies for those who wish to alter and diversify the uses of the Green River and its tributary waters. Biological investigations are underway to determine what flows are needed to protect the habitat for these fish. If additional flows are needed, it is the responsibility of the Upper Colorado River RIP to obtain these flows.

Drains installed in the Jensen area by the Bureau of Reclamation to take irrigation return flows to Stewart Lake have created a selenium problem with the wildlife. Median selenium concentrations in all drain water discharged to Stewart Lake have historically exceeded the state standard of five micrograms per liter established for wildlife protection. The drains have been diverted around the lake and now discharge directly into the Green River. Refer to Section 12.

The Mosby Canal on May 18, 1997, breached and joined with water from spring runoff to form an erosion gully that diverted 30 cfs of its water into Dry Fork Creek. The gully created by the flood water was 200 feet deep, about 400 feet across and 2,000 feet long. Flood flows washed nearly 1.5 million cubic yards of fine red soil into Dry Fork Creek, an important source of irrigation and culinary water for Ashley Valley.

Problems from the red sediment closed down the Ashley Valley Water Treatment Plant, filled canals and plugged sprinkler systems. The potential for future erosion and sediment deposition in Dry Fork and Ashley creeks still exist. The Ashley Creek Stabilization Project is being designed to solve these problems. Possible solutions are:

- Construct a reservoir on Trout Creek to store and regulate early spring stream flows.
- Stream bank stabilization - gabions and tree revetments.
- Stream bank tree and bush plantings.
- Rebuild the old Ashley Creek meander channel through Vernal.
- Riprap stream banks.
- Stabilize the gully with dead trees to collect sediment.
- Reseed the gully and sediment deposits.
- Further develop the capability to use Red Fleet water through the Ashley Valley Water Treatment Plant.
- Reestablish the trout fishery in Ashley Creek.

The Corps of Engineers is developing a plan to stabilize Ashley Creek above the Fort Thornburg Diversion. Gabions and riprap will be added to streambank sections to control the high stream flows.

7.4 Water Rights Regulation

Since 1903, under Utah water law, the only two ways to obtain the right to use surface water are by filing an application with the State Engineer and securing his approval or by acquiring an existing rights. Before approving an application to appropriate water, the State Engineer must find: 1) there is unappropriated water in the proposed source, 2) the proposed use will not impair existing rights, 3) the proposed plan is physically and economically feasible, 4) the applicant has the financial ability to complete the proposed works, and 5) the application was filed in good faith and not for the purpose of speculation or monopoly. The State Engineer can withhold action on, or outright reject, an application if it is determined it will interfere with an existing right and is detrimental to the public welfare or the natural resources environment. After the State Engineer approves an application, the applicant has a specific time to divert the water and put it to beneficial use. For good cause, this time may be extended. The applicant does the work and submits proof of appropriation, then the State Engineer issues a certificate of appropriation as evidence of a perfected water right.

An owner of a perfected water right may lose the right if beneficial use ceases for longer than five years. The owner may file for, and be granted, an extension of time to resume use to protect a right that is not being used. A provision in the state constitution (Article XI, Section 6) prohibits municipalities from selling or otherwise disposing of any water rights they hold. An exception is if they trade for other water rights of equal value.

7.5 Water Quality Control

The Utah Water Quality Act (UWQA) regulates discharge of pollutants. The Utah Water Quality Board (UWQB) carries out the regulations, policies and continuous planning necessary to prevent, control or abate surface and groundwater pollution. The UWQB develops and carries out Utah water quality rules under authority of *Utah Code Annotated* 26-11-1 through 20. They are described in Section 12 of the *State Water Plan*. The Division of Water Quality, Department of Environmental Quality, serves as staff to the UWQB.

Water quality certification by the state is covered under Section 401 of the federal Water Pollution Control Act (1977). This act requires state certification on any application for a federal license or permit resulting in discharge into waters and/or wetlands of the United States. These activities include, but are not limited to, the construction or operation of the discharging facilities. Any discharges must comply with applicable state water

quality standards and the applicable provisions of the Clean Water Act (CWA).

The UWQB adopts and enforces groundwater protection rules. These rules are the building blocks in a formal program to protect beneficial uses of groundwater in Utah. Three main regulatory concepts are provided. They are to: 1) prohibit the reduction of groundwater quality, 2) prevent groundwater contamination in the interest of obviating a need for after-the-fact clean-up, and 3) provide protection based on the differences in existing groundwater qualities. There are five significant components: 1) groundwater quality standards, 2) groundwater classification, 3) groundwater protection levels, 4) aquifer classification procedures, and 5) a groundwater discharge permit system. Statutory authority for the rules is contained in Chapter 19-5 of the *Utah Code Annotated*.

The groundwater protection rules contain a groundwater discharge permitting system that controls activities which may affect groundwater quality. A groundwater discharge permit is required if, under normal circumstances, there may be a release to groundwater. Owners of existing facilities are not obligated to apply for a groundwater discharge permit immediately. An existing facility is a facility or activity that was in operation or under construction before February 10, 1990. Owners of these facilities must nevertheless notify the Executive Secretary of the UWQB of the nature and location of their discharge.

These regulations provide for a permit by rule for certain facilities or activities. Many operations pose little or no threat to groundwater quality. Some are already adequately regulated by other agencies. These operations are automatically extended a permit and need not go through the formal permitting requirements. Therefore, facilities qualifying under provisions of Section R448-6-6.2 will administratively be extended a groundwater discharge permit (permit by rule). But these operations are not exempt from the applicable total dissolved solids (TDS) limits or groundwater quality standards.

The authority for CWA, Section 401 certification, commonly known as 401 Water Quality Certification, is carried out through the Utah Water Quality Board by the Division of Water Quality. Whether the EPA administers a CWA program directly or delegates it to a state, the EPA retains the oversight role to insure compliance with all rules, regulations and policies.

Local communities are encouraged to set up and carry out a local aquifer protection management plan. They can contact the Division of Water Quality for information and assistance.

7.6 Drinking Water Regulation

The Drinking Water Board is empowered to adopt and enforce rules establishing standards prescribing maximum contaminant levels in public water systems. This authority is given by Title 26, Chapter 12, Section 5 of the *Utah Code Annotated*, 1953. These standards govern turbidity as well as bacteriological, radiological, inorganic chemical and organic chemical quality. Standards are also set for monitoring frequency and procedures.

The Division of Drinking Water serves as staff for the Drinking Water Board to assure compliance with the standards. At the local level, considerable reliance is placed on public water supply operators. Those operating systems serving over 800 people are currently required to have state certification. Water systems serving fewer than 800 people will only need to have a certified operator if the water system has a treatment facility in place. Public community system details are presented in Section 11.

7.7 Environmental Considerations

Water is often viewed as a commodity for people's use with little thought given to other water use systems. Adequate quantity and quality of water is crucial to maintaining healthy wildlife habitats and populations. This includes providing instream flows where prudent and possible, and maintaining wetland areas.

The importance of providing instream flow as a beneficial use to maintain fish and wildlife populations, riparian vegetation, and stream channels is widely recognized. The Utah Legislature has recognized this through recent legislation. For example, the Division of Wildlife Resources and the Division of Parks and Recreation are empowered to

file application for permanent or temporary changes to regulate instream perfected water rights. Adequate water resources planning allows consideration of instream flow needs early in any project design process so these flows can be resolved before construction or operation of the project.

Wetlands are important for groundwater recharge and discharge, flood storage, shoreline stabilization, sediment trapping, water purification, pollution control, food chain support, fish and wildlife habitat establishment, and active and passive recreation. Stream channelization, draining or filling of wet areas can also impact wetlands.

Numerous potential sources of pollution may adversely affect the quality of groundwater. These sources include agriculture, on-site waste treatment systems, solid wastes, hydrologic modification, hazardous wastes, oil and gas exploration and production, mining, surface impoundments, timber harvesting, and urban runoff. The importance of groundwater as a resource should always be considered. Any developmental activities should emphasize protection of recharge areas of the major aquifers.

The Uintah Basin has several environmentally sensitive areas. These include the lower 2-1/2 miles of the Duchesne River (which has been designated as critical habitat for the razorback sucker by the U. S. Fish and Wildlife Service), Stewart Lake, Nine Mile Canyon, Ouray National Waterfowl Refuge, the Book Cliffs and the High Uinta Wilderness. These areas are shown and discussed in plans prepared by the Bureau of Land Management, U. S. Fish and Wildlife Service and the Forest Service. Protection and/or mitigation should be considered when water development is contemplated. The Green River has been designated critical habitat for the endangered fish.

7.8 Dam Safety[159]

All dams that impound over 20 acre-feet of water are assigned a hazard rating. Dams impounding less than 20 acre-feet may be ruled exempt if they do not constitute a threat to human life or property. Hazard ratings reflect either high, moderate or low damage potential if the dam failed. It does not reflect the condition or reliability of the dam, but rather the potential for loss of life or property damage in the event the dam were to fail. This determines the frequency of inspection. High-, moderate- and low-hazard dams are inspected every one, two and five years, respectively.

Following the inspection, a letter from the State Engineer suggests maintenance needs and requests specific repairs. The State Engineer can declare the dam unsafe and order it drained and even breached after drainage. Efforts are always made to work with dam owners to schedule necessary repairs.

The State Engineer has outlined design standards in a publication entitled, *State of Utah Statutes and Administration Rules for Dam Safety*. Plans and specifications must be consistent with these standards. Dam safety personnel monitor dam construction to insure compliance with plans, specifications and design reports. Any problems are resolved before final approval.

The State Engineer is currently assessing the ability of all high hazard dams to meet minimum safety requirements. The assessment includes seismic stability and the dam's capability to pass the appropriate Inflow Design Flood (IDF). Table 7-1 shows the dams classified as high hazard in the Uintah Basin. The Division of Water Rights rates federal dams, but these are exempt from requirements of the State Dam Safety Program. The Bureau of Reclamation inspects dams constructed under its programs.

The federal government holds title to all the major reservoirs in the Uintah Basin. As the storage facilities are finished, conservancy districts take over management and maintenance. ❑

Table 7-1
High Hazard Dams

Dam Name	Ownership	Year Completed	Height (Feet)	Capacity (Acre-Feet)
Big Sand Wash	Moon Lake WUA	1965	112	12,100
Bottle Hollow	BIA	1970	86	11,100
Currant Creek	CUP/BR	1977	177	15,670
Flaming Gorge	CUP/BR	1964	502	3,789,000
Moon Lake	BR/Moon WUA	1938	101	35,260
Red Fleet	CUP/BR	1980	161	26,170
Soldier Creek	CUP/BR	1973	251	1,106,500
Starvation	CUP/BR	1970	200	167,500
Steinaker	CUP/BR	1961	162	33,300
Brough	Ouray Park Irr. Co.	1975	75	3,100
Brown Draw	Moon Lake WUA	1981	89	5,900
Bullock Draw	Ouray Park Irr. Co.	1970	21	560
Chepeta Lake	Whiterocks Irr. Co.	1944	42	2,810
Cliff Lake (Duchesne)	Ouray Park Irr. Co.	1957	28	1,060
Cottonwood	Ouray Park Irr. Co.	1982	78	6,130
East Park	Wildlife Resources	1919	35	3,770
East Timothy	Moon Lake WUA	1951	37	620
LaPoint	Whiterocks Irr. Co.	1985	70	1,520
Long Park (Daggett)	Sheep Cr. Irr. Co.	1980	113	13,700
Montez Creek	Dry Gulch Irr. Co.	1937	48	1,220
Paradise Park	Whiterocks Irr. Co.	1924	42	3,140
Red Creek (Duchesne)	Red Creek Irr. Co.	1960	107	5,700
Twin Pots	Moon Lake WUA	1931	38	4,130
Upper Stillwater	CUP/BR	1987	195	32,009
Whiterocks Lake	Ouray Park Irr. Co.	1957	29	1,080

Content

Section 8
Uintah Basin Plan

Utah State Water Plan

Water Funding Programs

Federal, state and local governments are all part of the water program funding process.

8.1 Introduction

This section describes the funding sources for developing and conserving water resources in the Uintah Basin. Specific agency activities and responsibilities are presented. Funds for planning studies, programs and project construction are available from a number of federal, state and local funding sources. See Sections 3 and 8 in the *State Water Plan* (1990) for additional information on these programs.

8.2 Background

Funding of water development in this basin began with the sweat equity of the pioneers. Near the beginning of the 20th century, the federal government became involved in water development with the construction of a dam on Strawberry River. Most of the water developed was for agriculture and smaller amounts for municipal and industrial uses.

The Bonneville Unit of the Central Utah Project was initiated during the 1950s to bring water from the Duchesne River in the Upper Colorado River Basin to the Wasatch Front (Bonneville Basin). The cost of constructing the remaining facilities of the Bonneville Unit of the Central Utah Project will be shared among federal and various local entities. The Colorado River Salinity Program was introduced to reduce the salt loading from over-irrigation in the Uintah Basin. The cost for the project is cost-shared. State support is available for helping local project sponsors when necessary.

8.3 State Funding Programs

Tables 8-1 and 8-2 show current funding programs and the funding provided by state agencies for water-related projects. Funding can be grants and loans and be provided by more than one agency. These programs can accelerate water resources development by providing sufficient funds to construct projects that are otherwise not affordable to water suppliers.

8.4 Federal Water Funding Programs

Programs and historical expenditures of the eight federal agencies that administer water project funding programs are shown in Tables 8-3 and 8-4. Table 8-5 shows expenditures on large federal projects in the Uintah Basin by the U.S. Bureau of Reclamation.

8.5 Local Water Funding Programs

The Central Utah Water Conservancy District is primarily responsible for the administration, operation and maintenance of the Central Utah Project. These responsibilities include the sale of project water to cities, towns, communities and some smaller water providers. Because of its significant involvement in the use and distribution of project water, the district participates with water users (primarily water retailers) to improve and/or expand existing storage and distribution facilities. Funding is sometimes provided to other agencies to provide facilities for CUP purposes and are subject to approval by the district's board of directors.

A number of water districts provide funding for projects within their respective boundaries. Private financial institutions may fund water projects when sponsors have adequate repayment ability and bonding capacity. ❑

Table 8-1
State Funding Programs

Entity/Program	Contact Agency	Purpose	Type
Board of Water Resources	Div. of Water Resources		
Revolving Construction Fund		Small irrigation and culinary projects.	Loans
Cities Water Loan Fund		Municipal culinary water systems.	Loans
Conservation & Development Fund		Large water improvement projects.	Loans
Dam Safety		Stabilize and repair dams.	Loans & Grants
Community Impact Fund Board	Div. of Community Development		
Permanent Community Impact Fund		Schools, roads, medical, and water improvement.	Grants & Loans
Disaster Relief Board Fund		County or municipal flood repair.	Grants
Community Dev. Block Grants Policy Board	Div. of Community Development		
Community Development Block Grants Program		Improved living environment for small communities and counties.	Grants
Drinking Water Board	Div. of Drinking Water	Drinking water facilities.	
Construction Program			Loans
Water Quality Board	Div. of Water Quality	Wastewater treatment facilities.	Loans
Federal Construction Grants			
Wastewater Treatment Facilities Financial Assistance Program		Wastewater treatment facilities.	Grants
Soil Conservation Commission	Dept. of Agriculture	Improvment. of cropland and non-federal rangeland.	Loans
Agricultural Resource Development Loans		Watershed improvements.	Grants
NPS Program			
Board of Parks and Recreation	Div. of Parks and Recreation	Swimming, boating and other recreation-related facilities.	50/50 Cost-Sharing
Land & Water Conservation Fund			Grants
Wildlife Board	Div. of Wildlife Resources	Sport fishery management and boating access.	Grants
Wallup/Breaux Bill			

Table 8-2
State Water Funding Expenditures

Funding Agency/Program	Grants ($)	Loans ($)	Total Project ($)	Time Period
Board of Water Resources				
Revolving Construction Fund		7,601,195	13,871,184	1947-1998
Cities Water Loan Fund		4,691,300	15,744,601	1976-1998
Conservation & Development Fund		8,391,241	15,221,838	1980-1998
Dam Safety	150,196	88,000	348,642	1993-1998
Community Development Block Grants Policy				
Community Development Block Grants Program	1,747,920			1992-1996
Drinking Water Board				
Financial Construction Program			3,709,200	1990-1996
Water Quality Board				
Federal Construction Grants			2,896,000	1950-1990
Wastewater Treatment Facilities				
Financial Assistance Program		200,000	700,000	
Utah Soil Conservation Commission				
Agricultural Resource Development Loans		4,983,324		1988-1997
NPS Program		3,038,000		

Table 8-3
Federal Funding Programs

Agency	Program	Purpose	Type
Department of Agriculture	Agricultural Conservation Program	Soil, water energy conservation.	Grants
Farm Service Agency	Emergency Conservation Program	Rehabilitation of farmland damaged by disasters.	Grants
	Conservation Reserve Program	Reduce erosion, maintain wetland.	Grants
Rural Development	Rural Development	Water supply, wastewater disposal.	Grants,Loans
Natural Resources	Watershed Protection & Flood Prevention	Flood control and protection.	Grants, Cost-Share
Conservation Service	Resource Conservation & Development	Multi-purpose water & related facilities.	Grants, Cost-Share
	Emergency Watershed Program	Reduce sedimentation and flooding.	Grants
	Environment Quality Improvement Program	Soil and water conservation and quality improvement.	Grants, Cost-Share
	Resource Conservation & Development		
	Colorado River Salinity Control Program	Multi-purpose water/land conservation facilities.	Loans
		Reduction of salt load to the Colorado River.	Cost-share
Department of the Army	Civil Works	Flood control, water supply, recreation.	Cost-share
Corps of Engineers	Continuing Authorization Program	Flood control & protection.	Cost-share
	Emergency Activities	Flood control & protection.	Grants
	Flood Plain Management Program	Flood plain delineation.	Grants
Environmental Protection Agency	Non-point Source Program	Water quality.	Grants
Department of Interior	Investigation Program	Water storage, delivery.	Loans
Bureau of Reclamation	Loan Programs	Small multipurpose project.	Loans
Department of Housing and Urban Development	Community Development Block Grant Program	Water resources planning and development.	Grants
Federal Emergency Management Agency	Presidential-Declared Disaster	Damage mitigation.	Grants
	Flood Plain Management	Structure acquisition - flood plains.	Grants

Table 8-4
Federal Water Funding Expenditures

Funding Agency/Program	Grants	Loans	Total Project	Time Period
Farm Services Agency				
Agriculture Conservation Program	226, 000		226,000	1993-97
Corps of Engineers				
Civil Works	50,000		50,000	1984-97
Emergency Activities	60,000		60,000	1987-97
Continuing Authorities	135,000		135,000	1987-97
Natural Resources Cons. Service				
Watershed Protect & Flood Prev.	1,370,000		1,370,000	1992-96
Resource Cons. & Development	900,000		900,000	1992-96
Emergency Watershed Program	372,000		372,000	1992-96
Salinity Control Program	41,062,000		65,634,000	1992-97
Rural Utilities Service	14,262,500	17,400,200	31,662,700	1992-98

Table 8-5
Bureau of Reclamation Funding of Water Projects

Projects	Year Completed	Cost ($)
Strawberry Reservoir	1902	600,000
Moon Lake	1938	1,801,00
Vernal Unit	1963	10,402,000[a]
Jensen Unit	1980	62,576,000
Bonneville Unit	in Progress	1,238,645,000

[a] Does not include 12M for rehabilitation - completed in 1996

Content

Section 9

Uintah Basin Plan

Water Planning and Development

Most developable water has been put to beneficial use. Storage structure improvement and more intensive conservation and management measures will be the major focus of future water planning.

9.1 Introduction

This section describes the major past, present, and proposed water planning and development activities in the Uintah Basin. The current water planning and development in Duchesne and Uintah counties focus on determining the projects that will be included in the final phase of the Central Utah Project. The local water users are also taking advantage of the Colorado River Basin Salinity Control Program in a continuing effort to develop and better use the basin's water resources.

9.2 Background

Utah history is filled with examples of public participation in water resources planning and development. The federal government began its involvement in Utah water development activities in 1865 with the Indians and in the early 20th century with a dam on Strawberry River.

9.2.1 Past Water Planning and Development

Starting in about 1865, the Bureau of Indian Affairs (BIA) promoted irrigation by the Indians. By 1899, 14 canals of various capacities and lengths had been built by the BIA which carried water to small, scattered Indian farms. The Mormons also constructed a mile-long canal as part of their missionary work with the Indians. This canal (Wissup Ditch) was located about 15 miles south of Fort Duchesne below the mouth of the Uinta River.

The Uintah Indian Reservation Allotment Program of 1906 resulted in a convergence of cultures -- non-Indian and Indian -- and made non-Indian settlement possible on almost half of the original two million acres of reservation lands. This development created a complex patchwork of Indian and non-Indian lands served by an intermingled system of canals and ditches.

Lower Ashley Reservoir Site

The Ashley Central Canal, built in 1879, was the first organized effort to construct a group water system in Ashley Valley. The original canal was only 3.5 miles long and had the capacity to irrigate 9,000 acres around Vernal on the west side of Ashley Creek. When the Ashley Central Irrigation Company was incorporated in 1884, the canal was doubled in size, and the company appropriated one-third the flow of Ashley Creek. A system of laterals distributed the water to fields.

The Dry Gulch Irrigation Company was incorporated on December 1, 1905. Its Articles of Incorporation stated the company's purpose was to acquire use of the Uinta, Lake Fork and Duchesne rivers as well as springs and reservoirs for the lands west of the Uinta River, east of Lake Fork Creek and north of the Duchesne River. By December 1905 the company had applied for 850 cfs from Lake Fork, 860 cfs from Duchesne River and 600 cfs from the Uinta River. An application for 50,000 acre-feet of flood water from Lake Fork was also filed.

Storage rights in the High Uinta lakes were secured by the Dry Gulch Irrigation Company and Farnsworth Canal and Reservoir Company. The Farnsworth Canal and Reservoir Company was incorporated in 1908, and its water rights were junior to the Indian and the Dry Gulch Irrigation Company rights. As a result, the company could see the need for storage to ensure an adequate water supply. In 1915 it filed for storage rights for a total of about 5,000 acre-feet in Brown Duck, Kidney, Island and Clement lakes.

The Farmers Irrigation Company applied for storage in several small lakes during the 1910s and 1920s. These lakes in the Swift Creek Basin were Water Lily, Farmers, Deer, East Timothy and White Miller. The company also filed for storage rights in Bluebell, Drift, Superior and Five Points lakes in the Garfield Basin.

Chester Hartman and two neighbors filed for storage in Milk Lake in 1931 and constructed the first grouted masonry dam in the Uinta Mountains. The dam failed in 1940, was repaired and is still being used.

After water short years in the early 1930s, the Bureau of Indian Affairs was forced to impose increasingly strict water delivery conditions. The Bureau of Reclamation was enlisted for assistance and built Moon Lake Reservoir in 1937. The Moon Lake Project takes 23,000 acre-feet of Indian water from the upper Lake Fork River for delivery to stockholders in the Moon Lake Water Users Association in exchange for replacement water from the Duchesne River system into the lower Lake Fork River system by way of the Duchesne Feeder Canal to the Midview Reservoir area.

The Moon Lake Water Users Association controls about 85,320 acre-feet of second priority water rights on Lake Fork, Yellowstone and Uinta rivers. During the 1940s and 1950s, the term "water conservation" was used more and more. To these water users, this term really meant there was an ever-increasing need to store spring snowmelt runoff for irrigation use later in the growing season. As a result, the Moon Lake Water Users Association began acquiring additional high mountain storage rights. By 1963, it held rights in 14 lakes and one major exchange from the Duchesne River of more than 20,000 acre-feet annually.

Many other storage facilities, canals and ditches have been constructed over the years. These include several canals and ditches in the Tabiona-Hanna area, such as the Rhoades, Farm Creek, Jasper Pike and Tabby canals. Those around Duchesne include the Rocky Point, Gray Mountain and Pleasant Valley canals. In the Vernal-Jensen area, irrigation canals include the Highline, Rock Point, Union, Sunshine, Burns Bench, Central, Ashley Upper, Ashley Central, Steinaker, Burton, Island and Dodds. The Ashley Central, Dodds and Steinaker canals serve about 300 acres of farmland. The Vernal Unit was completed in 1962, with the exception of the Stewart Lake drains which were completed in 1981.

Big Sand Wash Reservoir, located north of Upalco, was completed in 1965 and supplies irrigation water to the Roosevelt area and north and south Myton benches. Sheep Creek Irrigation Company built Long Park Reservoir, an off-stream impoundment, in 1979. It is located on the north slope of the Uinta Mountains near Manila. The Sheep Creek Irrigation Company uses water from the reservoir for irrigation of about 11,400 acres, sells 200 acre-feet of water to Manila City, and has an agreement with the Utah Division of Wildlife Resources for a 3,000 acre-foot conservation pool. Two other reservoirs, Meeks Cabin and Stateline, were built as part of the U. S. Bureau of Reclamation's Lyman Project. The water from these reservoirs is exported from Utah and used in Wyoming. The small Greendale Canal diverts water to Greens Lake and the Greendale area. Matt Warner, Calder, Crouse and Browns lakes are managed by the Utah Division of Wildlife Resources for wildlife and fisheries.

Browns Draw Reservoir was built by the Moon Lake Water Users Association and stores about

5,900 acre-feet of irrigation water. A list of existing lakes and reservoirs is shown in Section 6, Table 6-1.

Central Utah Project[122]

The Central Utah Project (CUP) was originally divided into five separate units to facilitate planning and construction. Four of these units -- Vernal, Bonneville, Jensen and Upalco – were authorized for construction in 1956 by the Colorado River Storage Project Act. The Uintah Unit was authorized in 1968 by the Colorado River Basin Project Act.

The Jensen, Vernal, Upalco and Uintah units are situated entirely within the Uintah Basin. The Jensen and Vernal units have been completed and make water available for irrigation of Indian and non-Indian lands and for municipal and industrial use in Uintah County. The Bonneville Unit, nearing completion, involves water collection and distribution in the Uintah and Bonneville basins.

The Central Utah Completion Act directs the CUWCD to plan, design and construct remaining units of the CUP. Non-Indian projects to replace the Upalco and Uintah projects are currently being investigated with the DCWCD and Associated Water Users of the Lake Fork and Uintah rivers.

The Central Utah Water Conservancy District Board includes members who represent the Uintah Basin. Along with the Duchesne County Water Conservancy District, it will sponsor and contract with the United States Government for the repayment of the reimbursable costs of the redesigned Upalco and Uintah units. The Uintah Water Conservancy District has sponsored the Vernal and Jensen units. It is responsible for the sale and delivery of project water and will operate and maintain most of the project facilities.

The following is a brief description of three CUP units.

The **Bonneville Unit** is the largest and most complex of the CUP units. For planning and coordination purposes, it was divided into six systems according to location and function. These systems are: (1) Starvation Collection System, (2) Strawberry Collection System, (3) Ute Indian Tribal Development, (4) Diamond Fork System, (5) Municipal and Industrial System, and (6) Utah Lake Basin Project. All the systems are completed, except for part of the Diamond Fork System and the Utah Lake Basin Project System which is being re-scoped.

The Starvation Collection System was completed in 1970. The Starvation Reservoir stores about 167,300 acre-feet. It provides 22,600 acre-feet of late-season irrigation water for use on approximately 26,000 acres of land along the Duchesne River below Duchesne City. It also provides 500 acre-feet of municipal and industrial (M&I) water for Duchesne City. M&I water is delivered to Duchesne County entities, such as Duchesne City, East Duchesne WID, Johnson WID, Myton City and individuals.

The Strawberry Collection System, completed in the late 1980s, diverts part of the flows of Rock Creek and eight other tributaries of the Duchesne River and conveys the diverted flows through the 36.8 mile-long Strawberry Aqueduct to the enlarged Strawberry Reservoir. The Upper Stillwater and Currant Creek reservoirs serve as regulating reservoirs along the aqueduct. The Soldier Creek Dam increased the capacity of the Strawberry Reservoir from 273,000 to 1,106,500 acre-feet.

The Diamond Fork System facilitates the transbasin diversion of Bonneville Unit water from Strawberry Reservoir to the Bonneville Basin by way of the Diamond Fork and Spanish Fork rivers.

The M&I System provides water to Salt Lake and Wasatch counties and northern Utah County. The main feature is the 314,000 acre-foot Jordanelle Reservoir as well as the Jordan and Alpine aqueducts.

The Utah Lake Basin Project (formerly the Spanish Fork Canyon-Nephi Project) is being re-scoped. The allocation of Bonneville Unit water for the project will be evaluated, and new proposals will be developed.

To compensate the Ute Indian Tribe for anticipated economic losses associated with diminished stream fishing, Bottle Hollow Reservoir was constructed to provide recreation, fishing and wildlife activities.

The **Vernal Unit** furnishes municipal water for the communities of Vernal, Naples, Maeser, Glines and Davies. Completed in 1962, it provides supplemental irrigation water to about 15,000 acres of land in Ashley Valley by storing the high flows of Ashley Creek for late season use. Flows of Ashley

Creek are diverted at the Fort Thornburgh Diversion Dam, through the three mile-long Steinaker Feeder Canal, for storage in Steinaker Reservoir. This off-stream reservoir, four miles north of Vernal, has an active storage capacity of 33,300 acre-feet. Water from the reservoir is distributed through the Steinaker Service Canal. Project lands that previously received a partial water supply from the unregulated flows of Ashley Creek and frequently suffered crop failures are now assured a reliable water supply. Recreation and fishing facilities have been provided at Steinaker Reservoir.

The **Jensen Unit**[94] provides water for Ashley Valley and the area extending east to the Green River. About 18,000 acre-feet of water are available for municipal and industrial purposes in the Ashley Valley area and 4,600 acre-feet to supplement the irrigation supplies for about 4,600 acres of land near Jensen. Red Fleet Reservoir on Big Brush Creek, the Jensen Unit's major feature, has a total capacity of 26,000 acre-feet. The reservoir stores early spring runoff and surplus flows of Big Brush Creek for subsequent municipal, industrial and irrigation use. Recreation, fish, wildlife and flood control benefits are also part of the project.

Municipal and industrial water is lifted from Red Fleet Reservoir by the Tyzack Pumping Plant to Tyzack Aqueduct, which takes it to the Ashley Valley Water Purification Plant that is owned and operated by the CUWCD. Red Fleet Reservoir was planned and constructed during the "boom" days of the oil shale boom. But cheaper oil imports ushered in the "bust" days of the oil shale industry, leaving about 70 percent of Red Fleet water unsubscribed. The Burns Pumping Plant, not yet constructed, will pump water from the Green River for irrigation in the Jensen area. Unit water is also being provided to enhance the Stewart Lake Waterfowl Management Area.

The Central Utah Project, Ultimate Phase, Comprehensive Plan (1951), was to deliver water from Flaming Gorge Reservoir by aqueduct and canal and deliver water to lands near Neola, Bluebell, Upalco, Roosevelt, and as far west as Blue Bench north of Duchesne. Analysis by the BR determined that the Ultimate Phase did not meet the benefit-cost ratio and it was therefore never constructed. Duchesne County believed, however, the original CUP proposal promised water from the Green River to replace water taken from the Upper Duchesne River drainage. On March 12, 1996, the BR transferred to the Division of Water Resources excess water rights in Flaming Gorge Reservoir, part of which were for the Ultimate Phase. This right allowed for 447,500 acre-feet diverted or 158,890 acre-feet depleted. Duchesne County Water Conservancy District, seeing this as an opportunity to obtain water it believed was its, applied to the board for a portion of this right. The district was awarded 47,600 acre-feet of these water rights in January 1999 for M&I and agriculture.

The rest of the right was divided among 25 other applicants. Daggett, Duchesne and Uintah counties received total diversions of 200 acre-feet for M&I and 101,920 acre-feet for agriculture and depletions of 68 acre-feet for M&I and 57,329 acre-feet for agriculture. Table 9-1 shows a summary of Flaming Gorge water right apportionment for these three counties.

Bureau of Reclamation

The Bureau of Reclamation (BR) received funding during the Great Depression and built Moon Lake Reservoir (35,760 acre-feet) in 1937. The project helped control early spring flooding of Lake Fork River and provided storage for late summer irrigation. Strawberry Reservoir was also constructed by the BR in 1906. The reservoir had an active capacity of 270,000 acre-feet and stored spring runoff for diversion to Utah County (Strawberry Valley Project).

Natural Resources Conservation Service (NRCS)

The NRCS has been the major contributor for completing the projects and plans in the basin as follows:

- A watershed work plan for the Dry Fork Watershed Project[8] was prepared in 1970. The project objectives were to provide watershed protection, flood prevention, agricultural water storage, management, municipal and industrial water, and water for recreation and fisheries development. The project was abandoned in 1977 because a special use permit for water

Table 9-1
Summary of Flaming Gorge Water Right Apportionment

Assignee	County	Intended Use	Annual Acre-Feet Diversion	Annual Acre-Feet Depletion
Daggett County	Daggett	M&I	200	68
Duchesne County WCD	Duchesne	Ag	47,600	31,160
Uintah WCD	Uintah	Ag	51,800	24,745
K Ranch Water Company	Uintah	Ag	2,400	1,356
Brent D. Sheffer	Uintah	Ag	120	68
TOTALS			102,120	57,397

storage in the Ashley National Forest was not forthcoming from the federal government.

- A Watershed Protection Plan and Environmental Assessment was prepared for the Martin Lateral Watershed in the Dry Gulch area in 1981. The project covered an area west of Roosevelt. The principal objective was to improve downstream water quality and increase farm income. Land treatment was completed on 2,700 acres of irrigated cropland and pastureland. Work is continuing.

Local Agencies

Moon Lake Water Users Association and Dry Gulch Irrigation Company are major water providers and have used state funding. Smaller providers have also been major beneficiaries of state funding to develop their systems. Table 9-2 displays the projects funded by the state Board of Water Resources.

9.2.2 Current Water Planning and Development

Central Utah Project Completion Act

Major cities in the Bonneville Basin such as Salt Lake City, Provo and Orem will benefit from Central Utah Project completion. The Central Utah Project Completion Act (CUPCA) gave authority to the Central Utah Water Conservancy District (CUWCD) to replace the Bureau of Reclamation as the agency responsible for planning, designing and constructing remaining units of the project. Section 207 (b) of the CUPCA directed the district to prepare a *Water Management Improvement Plan* and submit it to the U. S. Secretary of the Interior. It includes a water conservation goal and an inventory of management improvement measures.

The six stated purposes of Section 207 are to:

- Encourage the conservation and wise use of water.

- Reduce the probability and duration of periods requiring extraordinary curtailment of water use.

- Achieve beneficial reductions in water use and system costs to prevent or eliminate unnecessary depletion of waters to assist in the improvement and maintenance of water quantity, quality, and streamflow conditions necessary to augment water supplies.

- Support fish, wildlife, recreation and other public benefits.

- Make prudent and efficient use of currently available water prior to any importation of Bear River water into Salt Lake County.

- Provide a systematic approach to the accomplishment of these purposes and an objective basis for measuring their achievements.

To carry out these purposes, the following activities are required:

- Water Management Improvement Plan

The CUPCA requires the plan be updated every three years and that it include the following elements:

Water Conservation Goal

The district's goal is 49,660 acre-feet per year. Fifty percent of the goal (25,000 acre-feet per year) must be achieved by 2005 and 100 percent by 2013.

Water Management Improvement Inventory

To be included on the active inventory, each proposed conservation measure must be found to be cost-effective (without significant adverse impact to the financial integrity of the district or a petitioner of project water), environmentally acceptable, in the public interest and has satisfied the requirements of the National Environmental Policy Act of 1969.

Comparative analysis of each cost-effective and environmentally acceptable measure.

Schedule of implementation for the following five years.

Assessment of the performance of previously implemented conservation measures.

- Water Pricing Policy Study

- Coordinate Operations Study of Independent Municipal, Industrial and Irrigation Systems.

- Establish a Utah Water Conservation Advisory Board.

Two projects were authorized under Section 207. They are the Island Ditch Project and the Sunshine Canal Project.

The Uintah Basin Replacement Projects (UBRP) are part of the Central Utah Project Completion Act (CUPCA) adopted by Congress in October 1992. The act's purpose is to complete a series of irrigation improvements planned by the U. S. Bureau of Reclamation (BR) since 1956. The intent of the legislation was to allow local water users, the Uintah and Ouray Indian tribes and the CUWCD to work together to identify and select alternative projects to those identified by the BR that are more economically and technically feasible and more environmentally desirable. However, the Uintah and Ouray Indian Tribes have withdrawn their support of the Uintah and Upalco projects.

The CUPCA requires a study to improve coordination among all water systems in the district's area. It looks at individual and interagency conservation programs and at coordinating projects. Objectives of the study are to:

- Improve the availability and reliability of the water supply.

- Coordinate the timing of reservoir releases under existing water rights to improve instream flows for fisheries, wildlife, recreation and other environmental values, if possible.

- Assist in managing drought emergencies by making more efficient use of facilities.

- Encourage the maintenance of existing wells which would be used for peak water demand.

- Allow for the development, protection and sustainable use of groundwater resources within the district's boundaries.

- Not reduce the benefits that would be generated in the absence of the joint operating procedures.

- Integrate management of surface and groundwater supplies and storage capability.

Table 9-2
Board of Water Resources Projects

Sponsor	Type	Date
DAGGETT COUNTY		
Daggett County Water & Sewer District	CL-SYST	09/09/85
Flaming Gorge Water System	CL-TANK	10/18/77
Manila Town	CL-TANK	04/22/76
Manila Town	CL-WELL	08/24/79
Sheep Creek Irrigation Company	CNL-ENL	12/22/47
Sheep Creek Irrigation Company	CANAL	07/02/60
Sheep Creek Irrigation Company	DAM-RES	12/08/76
Sheep Creek Irrigation Company	CNL-REP	09/12/83
Sheep Creek Irrigation Company	PR-PIPE	10/29/87
Sheep Creek Irrigation Company	SAFEDAM	08/01/94
Sheep Creek Irrigation Company	DAM-REP	09/23/96
DAGGETT COUNTY TOTAL 11		
DUCHESNE COUNTY		
Altamont Town	CL-TANK	06/28/77
Dry Gulch Irrigation Company	CANAL	04/18/51
Dry Gulch Irrigation Company	DAM-REP	09/25/52
Dry Gulch Irrigation Company	SAFEDAM	01/01/95
Dry Gulch Irrigation Company	SPRINKL	11/02/94
Duchesne Cnty Upper Country WID	CL-SYST	08/12/92
East Duchesne Culinary WID	CL-PIPE	05/11/82
East Duchesne Culinary WID	CL-PIPE	08/09/94
Farm Creek Irrigation Company	PR-PIPE	06/26/96
Fruitland WID	CL-SYST	11/30/89
Hidden Valley Irrigation Company	CANAL	01/26/60
Little Farm Creek Canal Company	SPRINKL	05/18/95
Monarch Canal Company	DAM-ENL	10/18/79
Moon Lake Water Users Association	DAM-RES	06/27/63
Moon Lake Water Users Association	DAM-RES	08/15/82
Moon Lake Water Users Association	SAFEDAM	08/01/93
Moon Lake Water Users Association	SAFEDAM	08/01/94
Moon Lake Water Users Association	SAFEDAM	08/01/94
Myton City	CL-TRMT	10/27/76
Neola Water & Sewer District	CL-SYST	11/08/85
Red Creek Irrigation Company	DAM-RES	10/30/59
Red Creek Irrigation Company	SPRINKL	05/26/89
Red Creek Irrigation Company	SAFEDAM	08/01/93
Rhoades Canal Company	PR-PIPE	05/15/93
Roosevelt City	CL-WELL	01/01/76
Roosevelt City	CL-WELL	06/28/84
Roosevelt City	CL-WELL	02/23/90
Tabiona Town	CL-TANK	09/29/76
Uintah Basin Irrigation Company	CANAL	10/17/57
DUCHESNE COUNTY TOTAL 29		
UINTAH COUNTY		
Ashley Central Irrigation Company	DIV-DAM	12/05/83
Ashley Upper Irrigation Company	DIV-DAM	03/09/84
Ashley Valley Reservoir Company	CNL-REP	08/05/81
Ballard Culinary Water Association	CL-PIPE	12/19/59
Burns Bench Irrigation Company	DIV-DAM	09/07/60

Table 9-2 (Continued)
Board of Water Resources Projects

Sponsor	Type	Date
Burns Bench Irrigation Company	PR-PIPE	11/06/61
Dry Gulch Irrigation Company	LH-PIPE	07/26/89
Highline Canal Company	DIV-DAM	01/14/55
Highline Canal Company	CANAL	08/31/79
Maeser WID	CL-WELL	04/27/78
Mosby Irrigation Company	PR-PIPE	11/01/73
Mosby Irrigation Company	LH-PIPE	10/18/77
Ouray Park Irrigation Company	CANAL	07/06/48
Ouray Park Irrigation Company	DAM-RES	08/05/57
Ouray Park Irrigation Company	CNL-ENL	10/25/66
Ouray Park Irrigation Company	DAM-RES	06/09/80
Sunshine Canal Company	PR-PIPE	11/13/92
Tridell-Lapoint WID	CL-TANK	04/27/78
Tridell-Lapoint WID	CL-TRMT	07/30/82
Vernal City	CL-TANK	07/10/86
White River Dam	MISCELL	05/07/82
Whiterocks Irrigation Company	DAM-RES	12/17/85
Whiterocks Irrigation Company	SAFEDAM	05/10/94
Whiterocks Irrigation Company	SAFEDAM	05/10/94
Whiterocks Irrigation Company	SAFEDAM	05/10/94
Whiterocks Irrigation Company	SAFEDAM	07/01/94

UINTAH COUNTY TOTAL 26

GRAND TOTAL 66

CODE	DESCRIPTION	CODE	DESCRIPTION
CL-CLOR	Culinary Chlorinator	DIV-DAM	Diversion Dam
CL-PIPE	" Pipe	DUAL-WS	Lawn & Garden Irrigation
CL-PUMP	" Pump	EQ-WELL	Equip. Well - Irrigation
CL-SPRI	" Spring	IR-PUMP	Irrigation Pump
CL-SYST	" New System	IR-WELL	Irrigation Well
CL-TANK	" Storage Tank	LH-PIPE	Low Head Pipe
CL-TRMT	" Treatment Plant	MISCELL	Miscellaneous
CL-WELL	" Well	PR-PIPE	Pressure - Pipe Irrigation
CANAL	Canal	REG-PON	Regulating Pond - Irrigation
CNL-ENL	Canal Enlargement	SPRINKL	Sprinkle Irrigation System
CNL-LNG	Canal Lining	STOCKWR	Stockwater Facilities
CNL-REP	Canal Repair	TUNNEL	Tunnel
DAM-ENL	Dam Enlargement	TUN-ENL	Tunnel Enlargement
DAM-REP	Dam Repair	TUN-REP	Tunnel Repair
DAM-RES	Dam & Reservoir (New)		

The Upalco and Uintah Units[132,17,18] were to be located in the central part of the Uintah Basin. The works associated with these units are not yet constructed. Several communities lie within the project boundaries including Roosevelt, Fort Duchesne, Altonah, Altamont, Bluebell, Mt. Emmons, Mountain Home, Talmage and Upalco.

The status of the proposed Uintah and Upalco Unit Replacement Projects is as follows:

- The Ute Indian Tribe has withdrawn its support for the projects.

- Smaller, downsized projects are being planned by the DCWCD, local irrigation companies and the CUWCD.

- Alternative projects to the Upalco and Uintah units, if built, will provide storage of early season runoff in project reservoirs to support late season irrigation needs so that basin farmers can bring their lands into cost-effective productivity. The increased supplemental water supply will extend the average growing season from two to three weeks.

- The project water will be developed from surplus flows, mostly spring runoff, of the Lake Fork, Yellowstone and Uinta rivers, all of which originate high on the south slopes of the Uinta Mountains. Additional supplies will come from savings of excessive seepage losses realized from the rehabilitation of existing canals and water saved from the retirement of marginal farmland.

Water Use Simulation Models

The district has helped develop technical models of the CUP and related features that show water users can benefit from coordinated operations. The Division of Water Resources has participated in a BR study of the selenium pollution reaching Stewart Lake. The division has created daily water supply computer simulation models for the Vernal-Jensen, Upalco and Uinta drainages as part of this effort. The water supply, diversions, storage and return flows are computed daily for a 43-year record. Existing and potential reservoirs can be modeled. Utah State University is providing a graphical interface to the model and a water quality model to calculate the quality of the water throughout the area, including the inflow to Stewart Lake.

Colorado River Basin Salinity Control Program[95,106]

The Colorado River Basin Salinity Control Program, a federal/state and local cooperative program, is ongoing in the Uintah Basin. The goal of the program is to reduce the salt-loading in the Colorado River from irrigation return flow and deep percolation. Water quality monitoring and evaluation data from the NRCS show a reduction of more than 92,300 tons per year has occurred in the Uintah Basin since the project started. The projected project total is 111,210 tons per year.

A monitoring and evaluation team has been in place in the Uintah Basin since the beginning of the program in 1990. The program has resulted in improving irrigation efficiency on more than 101,000 acres of land. More than 90,000 acres have converted from flood to sprinkler irrigation, increasing the irrigation efficiency from 56 percent to 84 percent. Another 13,000 acres have improved surface irrigation practices, resulting in an increased efficiency from 56 percent to 66 percent. This has resulted in the reduction of deep percolation of more than 61,000 acre-feet of water per year. These values show that the salinity program has been successful in meeting its goal of improving irrigation efficiency and reducing the salt load from over-irrigation in the Uintah Basin.

Water quality data from USGS shows that the salt load is decreasing in the Duchesne River since the salinity project started.

As part of the ongoing Salinity Control Program, the BR continues to investigate opportunities within the Duchesne River drainage to implement off-farm irrigation system improvements. Through modification of the timing of return flows, these improvements have the effect of reducing salt-loading to the Colorado River. These improvements would be implemented by local water users groups, funded through a competitive grant program administered by the BR.

The BR approved a $9 million grant in 1997 to Duchesne County Water Conservancy District to pipe five canals operated by five different canal companies. The canals that will undergo extensive improvements are the Payne Canal in the upper country north of Altamont, the Sandwash Canal in the Ioka/Upalco area, Uintah Basin Irrigation Company Canal in Pleasant Valley, Red Creek Canal in the Fruitland area, and a Dry Gulch Class "C" Canal in North Myton Bench. The 23-mile canal rehabilitation project will reduce the amount of salt flowing into the Colorado River.

Local Water Projects

The local water users have initiated investigations in projects such as Red Wash Dam, Lower Ashley Creek Dam, Leota Bench Supplemental Irrigation Project, Ashley Creek Stabilization Project, Alta Ditch, Highline and Upper Canal Project. See Figure 9-1 for project locations.

Red Wash Dam

The Uintah Water Conservancy District and Mosby Irrigation Company are sponsoring the Red Wash Dam. It is an off-stream reservoir supplied by a feeder canal from Deep Creek. The storage capacity would be 2,200 acre-feet, with a surface area of 85 acres. The dam would be 100 feet high, and stored water would be used for late season irrigation. The dam is located northeast of Lapoint. The Board of Water Resources has approved funding and some work has been completed.

Lower Ashley Creek Dam

The Lower Ashley Creek Dam is sponsored by the Uintah Water Conservancy District. The proposed reservoir would store winter and drain water from draws east of the reservoir site. Approximately 1,700 acres below the dam would receive supplemental water during late summer. Winter drain water from several draws would be diverted into Lower Ashley Reservoir by a canal to the reservoir site.

Leota Bench Supplemental Irrigation Project

The Leota Bench Project is sponsored by the Uintah Water Conservancy District and would pump water from the Green River to supplement irrigation water in the Leota Bench area. The Utah Board of Water Resources approved 8,400 acre-feet of water rights for the proposed project on August 8, 1996.

The pump station would pump water to the existing distribution system on Leota Bench. Supplemental irrigation water would be provided for 2,040 acres and new water for 670 acres.

Ashley Creek Stabilization Project

The proposed Ashley Creek Stabilization Project would include clearing existing snags and debris, creek bank restoration, installation of gabions, and removal of cobble, sand and debris from canal diversions. A dam on Trout Creek is proposed to reduce peak flows during spring flooding. A long-term goal is to restore Ashley Creek to its original channel in the flood plain.

Alta Ditch, Highline and Upper Canal Project

The project would combine these canals into a pipeline. The project would save water due to a reduction in canal seepage and provide a pressure system for sprinklers. The reduction in seepage would reduce salt loading to Ashley Creek. Funding would be provided by the Central Utah Water Conservancy District and the Bureau of Reclamation.

Red Creek, Sand Wash, Dry Gulch Class C, Pleasant Valley and Payne Canal Project

This project would line these canals and save water due to a reduction in canal seepage. Funding would be provided by the Bureau of Reclamation, Central Utah Water Conservancy District and Duchesne Water Conservancy District.

9.2.3 Environmental Considerations

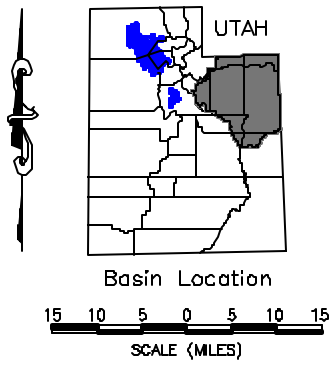
Section 301 of the Central Utah Project Completion Act establishes the Utah Reclamation Mitigation and Conservation Commission to coordinate the implementation of mitigation and conservation provisions. In addition, the commission is to administer the expenditure of funds for the implementation of the fish, wildlife and recreation mitigation, and conservation projects and features authorized in the act.

9.3 Water Resources Problems

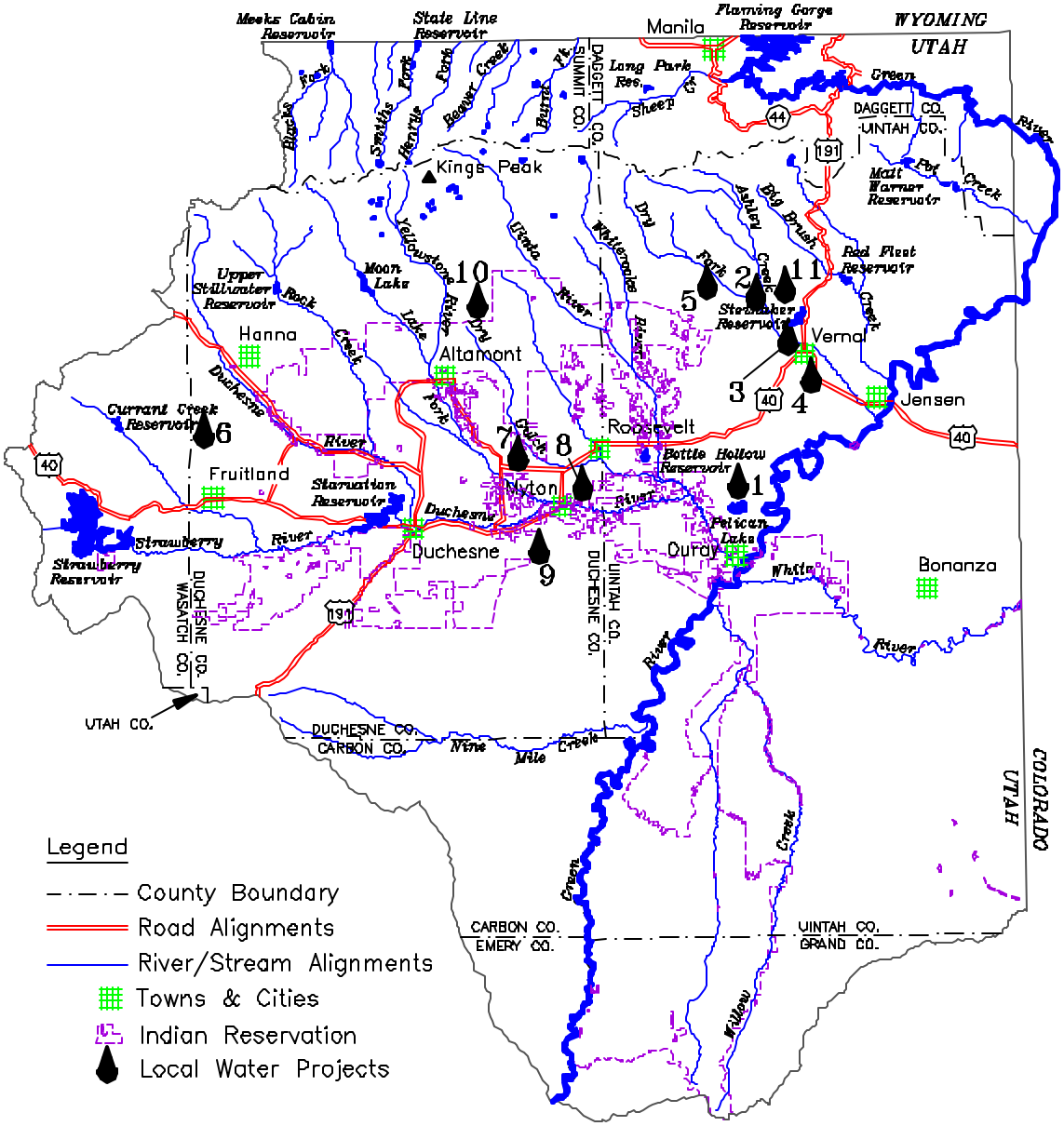
Water resources in the basin are adequate for municipal and industrial uses, but there is a shortage of irrigation water where no reservoir storage is available. The water users on the Yellowstone, Uinta and Whiterocks rivers have a need for late season irrigation water. Most of the spring snowmelt runoff is not stored or useable, due to unavailable reservoir storage.

Figure 9-1

LOCAL WATER PROJECTS
Uintah Basin



1 Leota Bench
2 Ashley Creek Stabilization
3 Highline/Upper Canal
4 Lower Ashley Creek
5 Redwash
6 Red Creek Irrigation
7 Sand Wash Irrigation
8 Dry Gulch Class C
9 Pleasant Valley
10 Payne Canal
11 Tyzach Aqueduct Reach III



Late summer storage is also needed for use south of Highway 40 in Lower Ashley. A lower Ashley Creek reservoir has been proposed to store available winter water and excess spring runoff.

9.4 Water Use and Projected Demands

Water use is divided into municipal and industrial, secondary, agricultural, recreational, and environmental categories.

9.4.1 Municipal and Industrial Water (M&I)[168,57]

Based on the existing use patterns and the population growth projections (Section 4 - Demographics and Economic Future), future water use needs were projected from 1995 to 2050.

Table 9-3 compares the projected M&I water demands of major water suppliers in the Uintah Basin with the projected M&I water supplies. Smaller systems are not included. The Uintah Basin has sufficient water supplies to meet anticipated M&I demands well beyond the year 2050. The water use data were obtained from meetings with all of the community water system managers. These data are summarized in *M&I Water Supply, Use and Rights in the Uintah Basin,* published by the Division of Water Resources.

9.4.2 Secondary Water

Several basin communities have secondary systems for delivering water to lawns, golf courses, gardens and other landscaping.

Water use in these systems is presented in Table 9-4. Secondary use is projected as a percentage of culinary use. Cities such as Roosevelt and Vernal use a secondary system to irrigate their golf courses and large grass areas.

9.4.3 Agricultural Irrigation Water[3,158,156]

Approximately 201,120 acres of land are irrigated in the Uintah Basin. Current diversions of 797,610 acre-feet of water are used for crop production. Table 9-5 shows the projected needs. Section 10 provides additional detail on agricultural water use.

9.4.4 Recreational Demands

Some of the state's most popular, water-based recreation is located in this basin. Strawberry, Currant Creek, Starvation, Upper Stillwater, Steinaker, Red Fleet, State Line and Flaming Gorge reservoirs provide about 100 square miles of reservoir recreation opportunities. Crowding has been a problem at Strawberry Reservoir for many years. Recreational demand for water is expected to be very strong in the future. More detail on this subject is provided in Section 15.

9.4.5 Environmental Needs/Demands

Water is needed for riparian vegetation, wetland maintenance, and instream flows for fish and wildlife. Phreatophytes are deep-rooted plants that obtain water from the water table or the soil just above. They occupy approximately 33,500 acres of wetland associated with irrigated land in this basin. Many of the phreatophyte areas, such as Stewart Lake, Pelican Lake and the Ouray National Waterfowl Refuge are considered valuable for wildlife. They also act as natural filters, removing some nutrients and other pollutants, such as selenium, from the waters that flow through them.

Since the passage of the Federal Endangered Species Act in 1973, four Colorado River fish have been listed as endangered. These are the Colorado pikeminnow, humpback chub, bonytail chub and the razorback sucker. All of these fish presently inhabit parts of the Green River system in Utah and Colorado.

In an effort to protect and nurture the endangered fish and allow continued development of Upper Colorado River Basin water, the Secretary of Interior, the Governors of Wyoming, Colorado and Utah, and the Administrator of the Western Area Power Administration were cosigners of a cooperative agreement. The purpose of the agreement is to implement the Recovery Implementation Program (RIP). The objective of the RIP is to identify and implement Reasonable and Prudent Alternatives (RPA) that will ensure the survival and recovery of the listed species while allowing new water development in the Upper Basin to continue. Many activities are ongoing in the Upper Basin to manage, develop and maintain

habitat, stock native fish, control non-native fish, and collect data and complete research.

The RIP operates on a principle of unanimous consent. Issues are significant and often controversial. One of the difficulties facing the RIP is the fundamental definition of recovery. Agreement has not been reached on what constitutes "recovery" of the fish, which has made clear objectives difficult to articulate. The RIP has, however, yielded a long-term plan. RIP committees agree annually on what can be done to improve conditions for fisheries and organize activities to carry out the objectives.

In the past, diversion of Duchesne River water under the Bonneville Unit has been permitted by the operation of Flaming Gorge Dam as a Reasonable and Prudent Alternative. However, in 1994 the lower 2.5 mile reach of the Duchesne River was designated as critical habitat for the razorback sucker. This action resulted in re-consultation on federal actions in the Duchesne River System. A Biological Opinion has been written for the Duchesne River, and RPAs have been included. The Biological Opinion addresses the continued transbasin diversion of Duchesne River water into the Utah Lake Drainage Basin.

One of the RIP activities recently completed was the *Duchesne River Hydrology and Water Availability Study*. The objectives of the study were to quantify the amount of water currently in the lower Duchesne River, compare this with the preliminary recommended flows determined by the U. S. Fish and Wildlife Service (USFWS), and identify potential sources of water that could be used to augment flows in the lower Duchesne. The USFWS preliminary recommended flows are not based on biological data or habitat needs of the endangered fish. Rather, they represent flows that historically occur in the river as recorded at the Randlett gage.

Other RPAs for the Duchesne River are included in the July 29, 1998 Duchesne River Biological Opinion. It is the responsibility of the RIP to implement the RPAs. Included in these RPAs are a five-year study to obtain biological information about the value and function of the lower Duchesne River for the endangered fish. Once the biological needs have been identified and evaluated, plans will be devised by the RIP to provide conditions for recovery of the endangered fish.

9.5 Alternatives For Meeting Water Needs

Most major water sources in the Uintah Basin will be developed (except the Green and White rivers) if the Central Utah Project, as currently authorized, is completed. However, small projects by local water users to better use or develop existing (local) water rights will continue to be investigated and, when feasible, constructed. Numerous opportunities have been identified by Central Utah Water Conservancy District consultants in a study on ways to coordinate operation of planned and present facilities and systems. Engineering and cost analyses have yet to be completed. Implementing feasible opportunities will provide maximum benefit from the use of the scarce water supply.

9.5.1 Water Supply Management

Several opportunities were identified by the CUPCA-mandated study of coordinating operations [Section 207(d)]to improve management of existing supplies. Contractual arrangements between municipalities and local farmers can be structured to transfer irrigation water to cities during serious drought periods, or cities could purchase water rights and lease unused water back to the farmers. These arrangements would provide municipalities with supplemental water when needed most without having to carry excess water rights that may be rarely needed. Irrigators would be compensated for any profit lost by the arrangement, and participation would be voluntary. Irrigation water used for raising small grains and pasture would more likely be made available than water used to produce alfalfa or other higher valued crops. An approved water right or change application would be required.

The Colorado River Basin Salinity Control Program organized a salinity monitoring and evaluation team (M&E). The objectives of the M&E program are to:

- Monitor and evaluate changes in the salt load entering the Colorado River system.

Table 9-3
Uintah Basin Projected M&I Demand and Supply
(Major Public Suppliers)[a]

Year	1995 Population Projection	Water Demand (Diversions)	Water Demand (Depletions)	Water Supply	Surplus
			(acre-feet/year)		
1995	39,460	12,110	6,050	48,730	36,520
2000	42,510	13,140	6,570	48,730	35,590
2010	48,610	15,020	7,510	48,730	33,710
2020	54,710	16,900	8,450	48,730	31,830
2050	87,020	26,940	13,470	48,730	21,790

[a]Includes residential and commercial total potable use. Includes secondary water use.

Table 9-4
1995 Secondary Water Use and Projected Demand

Year	County			Total Diversion	Total Depletions
	Daggett	Duchesne	Uintah		
		(acre-feet)			
1995	70	1,050	1,380	2,500	1,750
2000	80	1,120	1,490	2,690	1,880
2010	90	1,280	1,710	3,080	2,160
2020	110	1,430	1,920	3,460	2,420
2050	130	1,560	2,220	3,910	2,740

Table 9-5
Irrigation Water Use and Projected Demand

Year	Hydrologic Study Area					Total[a] Demand	Total Depletions
	Upper Green	Ashley/ Brush	Duchesne/ Strawberry	Green	White		
			(acre-feet)				
1995	50,540	82,570	537,100	121,310	6,090	797,610	411,310
2020	50,020	81,450	532,510	120,410	6,090	790,480	407,630
2050	49,390	80,110	527,000	119,330	6,090	781,920	403,220

[a]Agricultural Diversions

- Monitor and evaluate changes in a wildlife habitat as a result of the salinity program.

- Monitor and evaluate the on-farm economic impacts and development information that the operator and field office planning staff can use.

- Monitor only operators who presently are, or previously have been, participants in the Colorado River Salinity Control Program.

Monitoring of 780 irrigated acres of surface and sprinkler systems showed a reduction in salt-loading to the Colorado River System.

Irrigation water "call systems" have been operating by the Dry Gulch and the Lake Fork irrigation companies. Each user has a set water (acre-feet) allotment for the year stored in Big Sand Wash and Moon Lake reservoirs. When the user needs water, they call the ditch rider, and the required amount of water is released into the canal for use by the user. If the user does not use their allotment during the year, the water can be stored and used the next year. Each user does not know his or her set allotment until the end of the irrigation season. The users start the year with an allotment of carry-over storage, plus any winter storage and any credits of natural flow. Project or storage water is credited as it becomes available during the irrigation season. The Uintah Water Conservancy District is currently incorporating the irrigation water call system for the Ashley Valley. Water stored in Steinaker Reservoir, in combination with Ashley Creek flows, will be distributed to the farmers as needed.

9.5.2 Surface Water Storage Facilities

When the Central Utah Project is completed, most large, feasible surface water storage sites, except the White River dam site, will be developed. Upstream storage capacity is increasing the flexibility in the system. Keeping as much water as possible in the upper reservoirs allows these supplies to be released on an "as called for" basis to a broader service area. Lower elevation reservoirs can be used to provide supplemental capacity. Demands would be met from the lowest possible source, thus maximizing the flexibility. An added benefit may be reduced system-wide evaporation losses, since upstream reservoirs are located where there are lower temperatures and less evaporation. These reservoirs are generally deeper and have higher retention efficiencies.

More aggressive operation of reservoirs using real time data (automated call systems) and better modeling of storage systems may increase usable surface water supplies. In some areas, multiple upstream reservoirs feed lower downstream rights. Downstream water demands can be met more efficiently when the multiple reservoirs are operated as a single system to fulfill the downstream demands rather than relying on the specific water rights.

Operation of the multiple reservoirs as a single system improves flexibility. Current examples are the Strawberry/Starvation System and the Cottonwood and Brough reservoirs. Close monitoring and measuring of irrigation water is required.

9.5.3 Cloud Seeding

The Utah Cloud Seeding Program has the goal of increasing winter precipitation within targeted mountain watersheds. Enhanced winter snowpack leads to additional surface stream flow runoff and underground water storage during the spring and summer months.

A cloud-seeding project operated in Daggett, Duchesne and Uintah counties in 1977, 1978 and 1989. Some basin residents believed cloud seeding on the Wasatch Front was reducing the Uintah Basin's precipitation. However, independent studies at Utah and Colorado State universities concluded that an increase of about 15 percent occurs.

9.5.4 Water Education

Numerous programs are available for promoting water conservation. The programs include exchanging new low-flow toilets and shower heads for old ones, secondary irrigation systems, and conservation inducing price structures. These programs are explained in more detail in Section 17, Water Conservation.

The annual Young Artists' Water Education Poster Contest is an event which continues to be the highlight of October, which is Water Education month. Children in kindergarten to 6th grade

participate in this statewide contest each year. Themes chosen each year all relate to water as a resource.

Education provides one of the best approaches to ensuring responsible behavior toward water. Project WET (Water Education for Teachers), through its education services and programs, will help prepare students for citizenship in the next century.

9.6 Issues and Recommendations

Issue addressed: Local water management plans.

9.6.1 Local Water Planning

Issue - Many communities are not adequately planning for future growth.

Discussion - Water purveyors need to plan for their future growth. Community leaders should plan for a combination of water supply, water quality and conservation strategies that will provide an integrated structural and nonstructural program to meet their needs.

Various scenarios can be explored to consider all the options available to the communities. Least-cost analysis may be used, with water conservation and environmental impacts given full consideration. Groundwater sources will be considered along with conversion of agricultural water and water conservation through better efficiencies within and outside the community's homes.

The plan should be reappraised periodically. By updating population projections, reevaluating water source quality and capacities, and incorporating new conservation methods as they become available, people responsible for water delivery will be alerted to problems that are beyond their term of office and yet require timely action for the future quality of life.

Recommendation - Most communities and/or water utilities should prepare a long-term water management plan which includes new water supply sources and water conservation programs. The plans should be reviewed and updated periodically. To encourage management and conservation planning, water funding agencies should require plans as a condition of state cost-sharing. ❑

Content

Section 10

Uintah Basin Plan

Utah State Water Plan

Agricultural Water

Agriculture is the main industry in the Uintah Basin, followed by oil production, mining and tourism.

10.1 Introduction

This section describes the agricultural industry in the basin, along with its problems and future destiny. Agriculture is the largest user of land and water. Most of the irrigated lands have a good water supply, except lands not served by reservoir storage.

10.2 Background

Uintah County ranks number 12 in the state in annual agricultural income at $23 million, Duchesne County is number six at $35.5 million, and Daggett County is number 26 at $1.3 million. In Daggett County, agriculture income ranks number five countywide, with construction, TCPU, services and government generating more income. The Uintah Basin is still mostly rural, but only a few farms and ranches provide full-time employment. Many farms in the basin are part-time operations, with farmers working full-time at other employment. The portions of Summit and Wasatch counties within the basin are primarily used for agriculture and ranching. Ninety percent of the farmers in Daggett, Duchesne and Uintah counties are dependent upon beef production for their income. More than 90 percent of the farms are devoted to cattle grazing and associated agriculture. The irrigated land is located in various locations, such as river bottoms and plateau tops.

The Colorado River Storage Project Act (CRSP) provides for the comprehensive development of the Upper Colorado River Basin. Starvation Reservoir stores irrigation water for upstream and downstream users along the Duchesne River. Steinaker and Red Fleet reservoirs provide irrigation and municipal and industrial water for Ashley Valley and the Jensen area. This long-term storage allows the users to irrigate throughout the growing season. Other reservoirs, such as Strawberry, Current Creek and Upper Stillwater, provide protection and some long-term storage for irrigation, but primarily provide long-term storage for diversions to the Bonneville Basin. This storage is needed to deliver a reliable water supply throughout the growing season. Some drilled wells to supplement the irrigation supply. Some water is also pumped from the Green River for farms along its river bank.

Sprinklers in Jensen area

10.3 Agricultural Lands

The Uintah Basin has suitable climatic and soil conditions for diversified irrigated farm agriculture. Beef and some dairy farming are the principal farm enterprises. In the lower Roosevelt area and Ashley Valley, salinity derived from the Mancos Shale is a problem. When excess irrigation water is applied to a field, alkali is drawn to the surface and carried away by waste water. The Colorado River Basin Salinity Control Program helps reduce this salt-loading through irrigation water management. Lands historically worked with flood irrigation are increasingly now irrigated via sprinkler systems. This has helped preserve or increase the productivity of cropland in the area.

Hay harvest near Vernal

10.3.1 Irrigated Cropland[154,156,145]

The Division of Water Resources report, *Water-Related Land Use Inventory of the Uintah Basin*, shows approximately 201,120 acres of privately owned irrigated crop and pasture lands in the Uintah Basin. This includes Indian and non-Indian lands. The average irrigated farm is approximately 130 acres in Uintah County, 170 acres in Duchesne County, and 150 acres in Daggett County. The principal crops grown are pasture (37 percent), alfalfa (29 percent), grass hay (15 percent), small grains (5 percent), corn, grain and silage (3 percent). Irrigated cropland depletes 411,320 acre-feet of irrigation water. Table 10-1 shows the acreage for each crop. Irrigated cropland is shown on Figure 10-1. Changes have occurred in geographical distribution of major crops grown over the past 20 years in the Uintah Basin. Alfalfa and small grain production has remained stable in terms of acreage. This production, however, is concentrated in areas of well-drained soils and where sprinkler irrigation is practiced.

10.3.2 Dry Cropland

Dry farm production of wheat is very limited in the basin, amounting to about 2,400 acres, mostly on Diamond Mountain which is located northeast of Vernal.

10.3.3 Other Lands

Urban lands (cities, farmsteads and developed areas) total about 18,170 acres. Most of the remaining land area consists of rangeland, wetlands and national forests. According to the *Utah Conservation Needs Inventory Report*, issued in 1970, there are 349,930 acres of private range land in Uintah County, 783,590 acres in Duchesne County and 63,550 acres in Daggett County. Additional rangeland is used for livestock grazing and wildlife. These lands are administered by the Forest Service and Bureau of Land Management.

10.4 Agricultural Water Problems and Needs

Water problems in the agricultural sector are centered around supply shortages.

Table 10-1
Irrigated Land by Crop - 1994

Crop	Carbon	Daggett	Emery	Duchesne	Summit	Uintah	Wasatch	Total
				(acres)				
Fruit	0	0	0	3	0	30	0	33
Grain	0	7	0	6,583	0	3,356	54	10,000
Corn	5	0	0	2,550	0	3,019	0	5,574
Vegetables	0	0	0	19	0	2	0	21
Alfalfa	248	2,318	31	28,106	1	30,963	289	61,956
Grass Hay	4	4,526	0	18,853	334	6,864	687	31,268
Grass/Turf	0	0	0	5	0	0	0	5
Pasture	187	2,705	77	44,827	739	28,908	504	77,947
Sub-Irrigated	0	758	0	75	62	1,970	2	2,867
Hay/Grass	0	1,025	0	4,092	1,339	4,788	205	11,449
Total	444	11,339	108	105,113	2,475	79,900	1,741	201,120

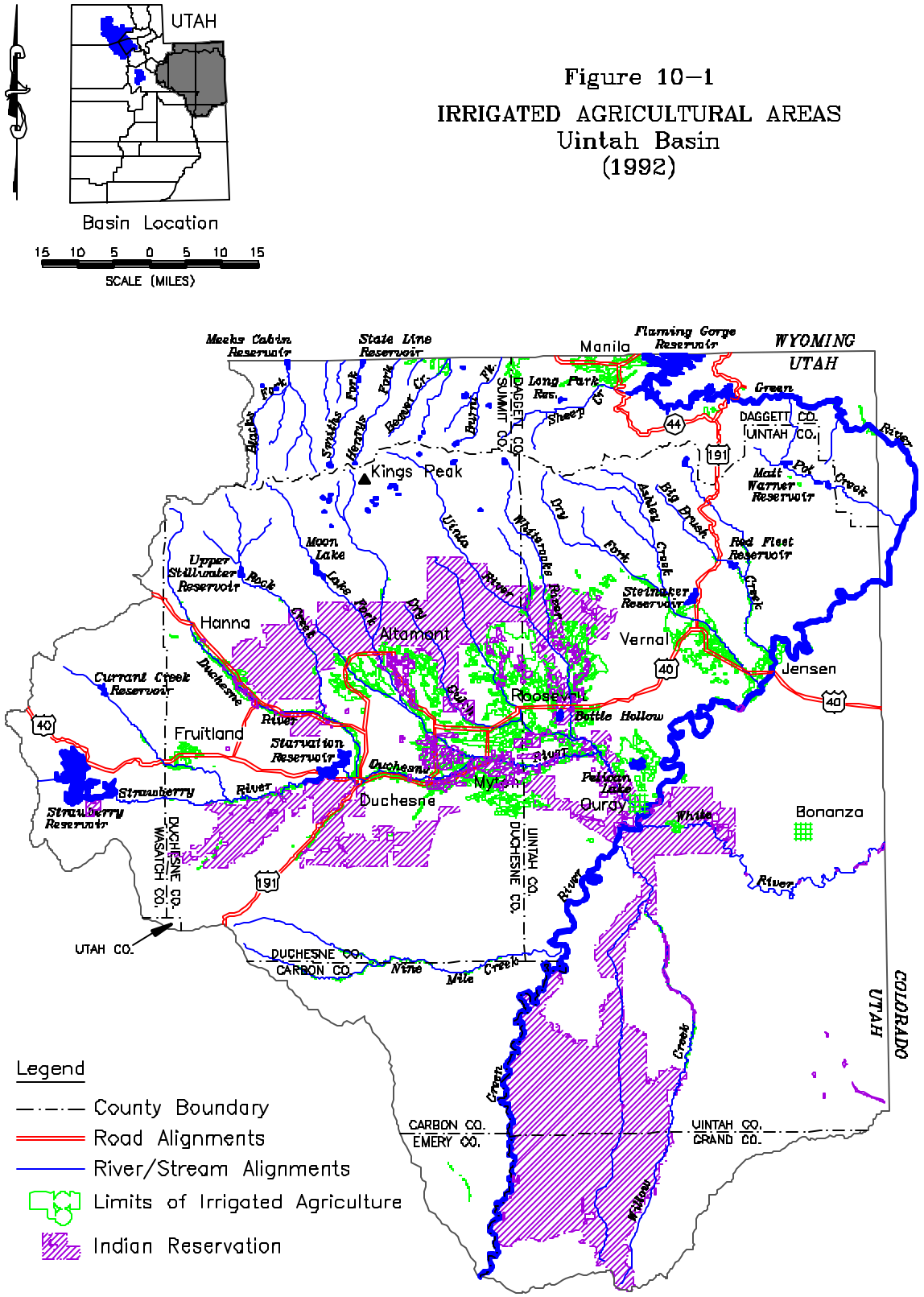


Figure 10–1

IRRIGATED AGRICULTURAL AREAS
Uintah Basin
(1992)

Table 10-2
Current And Projected Irrigated Cropland

Year	Carbon	Daggett	Duchesne	Emery	Summit	Uintah	Wasatch	Total
				(Acres)				
1994	440	11,340	105,110	190	2,480	79,950	1,740	201,120[a]
2020	440	10,890	104,210	190	2,480	79,090	1,840	199,140
2050	440	10,850	103,310	190	2,480	78,290	1,930	197,490

[a]Water-Related Land Use Inventories - Uinta Study Unit

10.4.1 Irrigation Water Shortages

Future demands for irrigation water should remain about the same. Some farmlands are high in salt toxicity, and other lands and homesteads have been abandoned and reverted back to pasture. However, some of this farmland could be irrigated if reservoir storage could be provided. The Upalco and Uintah Replacement Projects, if constructed, will extend the water supply for the growing season by about two to three weeks.

Irrigation water is usually plentiful in the spring and early summer but scarce near the end of each growing season. Without storage of peak spring flows, late season irrigation is impossible. More reservoir storage is needed to supply supplemental water for water-short areas and during dry years. Water conservation methods such as sprinkler irrigation and canal lining should also help increase the water supply.

10.4.2 Erosion

Soil loss through erosion occurs on lands in the upper watershed, on dry farm lands during snowmelt runoff, and on irrigated cropland. The most critical erosion problems are occurring on flood-irrigated row crops where soil losses approach 10 tons per acre per year in some areas.

10.4.3 Cropland Conversion

Irrigated cropland is not expected to change much in the next 20 years; however, a small amount of land will be lost to urbanization. Table 10-2 shows the current and projected irrigated cropland acreages. The amount of water needed for irrigation of crops to the year 2050 is estimated in Section 9, Table 9-4. Figure 10-1 shows irrigated agricultural areas.

10.4.4 Salt Problem

Crop yields have decreased in areas with poor drainage and salt toxicity problems. Decreased yields of alfalfa and small grains are also evident in areas where over-irrigation has occurred. However, the Colorado River Salinity Project has helped to increase crop yields through better irrigation practices, such as sprinkler and gated pipe irrigation.

10.5 Conservation and Development Alternatives

Upgrading old irrigation systems and installing new efficient lawn and garden systems are conservation and development objectives.

10.5.1 Conveyance Systems

New projects such as the Upalco and Uintah Units of the CUP could entail replacement or combination of old canals and ditches and construction of two small reservoirs. The additional water supply will be used for supplemental irrigation water. The Uintah Unit will provide an average supply of 12,320 acre-feet for Indian water needs and 6,650 acre-feet of non-Indian water. The Upalco Unit will provide an average supply of 9,230 acre-feet Indian water and 10,280 acre-feet non-Indian water. Some additional water will become available for other uses if the projects are completed.

Uintah Basin Canal Project

As part of the ongoing Salinity Control Program, the Bureau of Reclamation (BR) is investigating several opportunities within the Duchesne River drainage to implement off-farm canal irrigation system improvements. Through modification of the timing of return flows, these improvements have the effect of reducing salt loading to the Colorado River. These improvements would be implemented by local water user groups, funded through a competitive grant program administered by the BR.

10.5.2 Application Methods

Changes could also occur in on-farm application efficiency in Uintah and Duchesne counties, if the proposed projects proceed. Pipelines and sprinkler systems will be constructed under the Colorado River Salinity Control Project.

10.5.3 Watershed Management

Watershed projects for Sand Wash and Hancock Cove have been completed by the Natural Resources Conservation Service. More work is underway for the Martin Lateral. Watershed studies for Pot Creek and Red Creek Wash were completed by the Division of Wildlife Resources. The Central Utah Water Conservancy District completed watershed management studies for the Uintah and Upalco Units of the Uintah Basin Replacement Project.

10.6 Issues and Recommendations

Three water policy issues affecting agriculture are: reservoir water storage, flood control and salinity.

10.6.1 Need for Reservoir Water Storage

Issue - A shortage of irrigation water generally occurs during July and August due to inadequate reservoir storage in the basin.

Discussion - Farm areas below streams with inadequate or no reservoir storage run out of irrigation water in July during dry years. Third crop hay dries up and a low yield occurs. Water storage on Yellowstone, Uinta and Whiterocks rivers and upper and lower Ashley Creek is needed. Water could be stored during the winter and high spring flood runoff for later use during the late summer months. Where storage is not available, shortages also occur before the spring runoff. The reservoirs should therefore be large enough for carry-over storage.

Recommendation - Storage reservoirs should be constructed on the Yellowstone, Uinta and Whiterocks rivers and upper and lower Ashley Creek.

10.6.2 Flood Control

Issue - Ashley Creek needs flood control and bank stabilization during wet years.

Discussion - Ashley Creek, during wet cycles, floods the surrounding countryside and destroys its banks. After earlier flooding in 1983-1984 and 1997, the Corps of Engineers straightened and rebuilt some of the stream channel. This work only increased the flooding and bank erosion. Stabilization of the stream is needed, which includes rebuilding old meanders, higher and longer bridges, and reinforcing the stream channel at strategic locations. High stream flows should be stored in an upstream reservoir and released over a longer duration.

Recommendation - A reservoir should be built to reduce the high flow peak. Old meanders should be rebuilt and the stream stabilized. Larger bridges should be built crossing Ashley Creek.

10.6.3 Need to Continue the Salinity Control Program

Issue - The Salinity Control Program has been reduced in recent years.

Discussion - The federal govenment has reduced the Salinity Control Program funding. Reduced funding will slow the completion of projects associated with the Colorado River Salinity Program and may eventually violate the treaty with Mexico. To date, the salinity reduction program has reduced the salt load in the Duchesne River by 92,300 tons of salt per year by increasing the efficiency of irrigation systems and management. Of the original goal of improving irrigation practices on 137,000 acres, 37,000 acres remain to be treated. Better efficiency also means more profit for the irrigator.

Recommendation - The Colorado River Salinity Control Program in the Uintah Basin should be fully funded and completed. ❑

Content

Section 11
Uintah Basin Plan

Utah State Water Plan

Drinking Water

Constant vigilance is required to assure high quality drinking water will always be available for a growing population.

11.1 Introduction

This section discusses public and private water supplies in the basin and reviews their present status. A public water system as defined by the Utah Division of Drinking Water (DDW) is one serving at least 15 connections or 25 people 60 days per year. Water from public systems is used for culinary, lawn and garden, car washing and many other uses. Industrial firms use water from public water systems also. Section 18 deals specifically with this use.

Head of the Uinta River

11.2 Setting

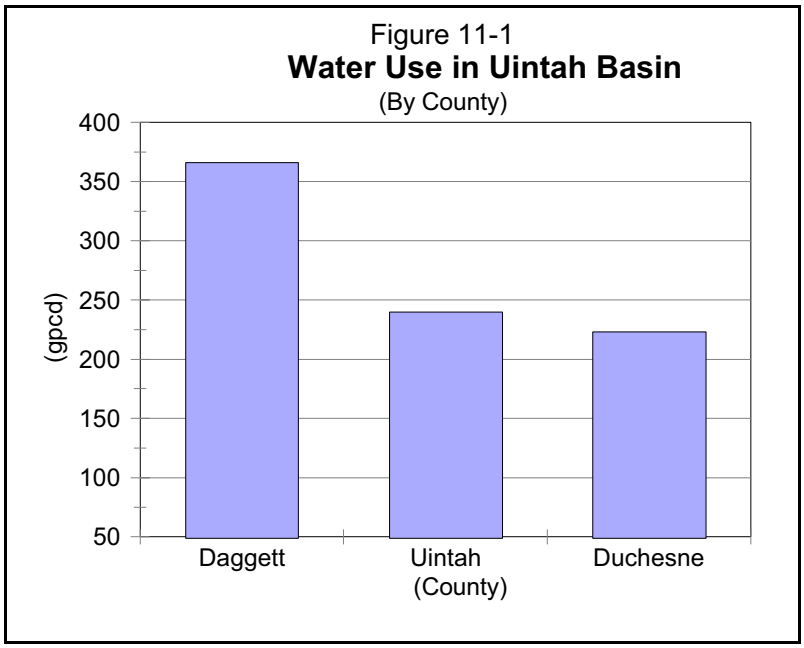
Municipal and industrial water use from community water systems in the Uintah Basin in 1995 was an average 276 gallons per capita per day (gpcd). This number included only potable water and does not include secondary water. The statewide average was 268 gallons gpcd in 1998. Use in counties varied from 223 gpcd in Duchesne, 366 gpcd in Daggett, and 240 gpcd in Uintah. Most of the variability among counties can be attributed to the amount of culinary water used for outside lawn and garden irrigation, and the number of tourists from outside the area, especially in Manila where Flaming Gorge Reservoir is located. Figure 11-1 shows water use in the Uintah Basin. Daggett County is high in use due to gallons per capacity per day consumed by summer tourists.

11.3 Organizations and Regulations

All public drinking water supplies are subject to the *State of Utah Administrative Rules for Public Drinking Water Systems* (R309-200 through R309-211). The Utah Department of Environmental Quality, Division of Drinking Water, administers the rules. In addition, the Division of Water Rights and the Board of Health have responsibility for approving how drinking water wells are constructed.

11.3.1 Local

Towns and cities have primary responsibility for drinking water quality control within their respective jurisdictions. Under state drinking water rules, public water facilities are categorized as: 1) community, 2) non-transient non-community, or 3) transient non-community water systems. The



Division of Drinking Water designates each as approved or not approved on the basis of compliance with state drinking water rules. The basin has 28 approved public drinking water systems, shown in Table 11-1.

Table 11-1
Public Drinking Water System Ratings

Rating	Daggett	Duchesne	Uintah	Total
Approved	6	13	9	28
Not Approved	0	0	0	0
Corrective Action	0	0	0	0
Totals	6	13	9	28

Community water systems are public water systems serving at least 15 service connections used by year-round residents. Service is typically water distribution but may also include water treatment. Non-community systems provide seasonal water service to non-transient non-residents (e.g., school children, church congregations, etc.) or to transient non-residents (e.g., tourists, restaurant patrons, etc.). Non-community systems are usually owned and operated by small public organizations, although some exist to provide commercial and industrial drinking water. Some isolated farms and ranches still transport their drinking water in water trucks, due to the excess cost of installing water systems to their areas. The Utah Division of Drinking Water (DDW) also regulates such water haulers (R309-211-10).

All public water systems in the basin have their own drinking water sources, but many receive additional water from districts such as the Central Utah Water Conservancy District and the Uintah Water Conservancy District. In the case of Vernal City, about 3,000 acre-feet per year of water is processed by Ashley Valley Water Treatment Plant (AVWTP). A new aqueduct (Tyzack Aqueduct Reach 3) will enable Maeser, Jensen and Ashley Valley to receive water from the Central Utah Water Treatment Plant.

Duchesne City uses water from Starvation Reservoir. A water treatment plant is situated adjacent to Starvation Dam and produces about 1,500 acre-feet per year (2.5 mgd) of water for municipal and industrial (M&I) use in Duchesne and vicinity. Manila receives about 280 acre-feet per year of Long Park Reservoir water from Sheep Creek Irrigation Company. Public community system boundaries are shown on Figure 11-2.

11.3.2 State

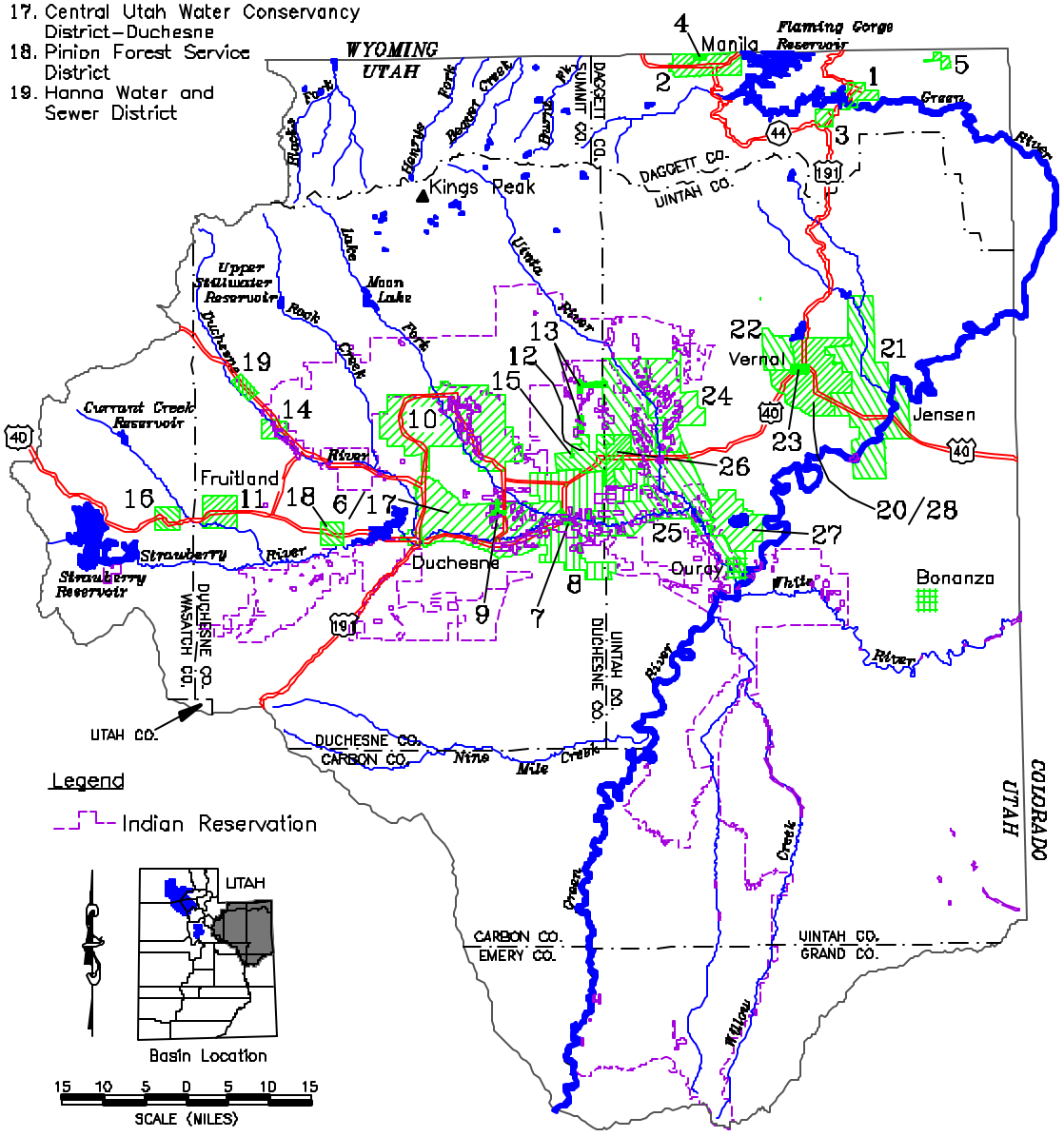
Verification that a public water system is complying with state rules and federal regulations is made through monitoring programs established by state and federal authorities. The *Utah Administrative Rules for Public Drinking Water Systems* (R309-200 through R309-211) outlines the procedures local facility operators must follow when taking water samples. The rules also outline the documentation requirements of subsequent water quality analyses for submission to the DDW and the state's responsibility to administer programs designed to monitor existing drinking water quality. Monitoring is testing and analyzing water samples. The rules also set contaminant levels of various water impurities and provide a protocol for application to the state for funds to design, construct and operate drinking water treatment and distribution facilities.

Figure 11-2
PUBLIC COMMUNITY SYSTEM BOUNDARIES
Uintah Basin

DAGGETT COUNTY
1. Dutch John (Bureau of Reclamation)
2. Daggett County Water & Sewer
3. Greendale Water Company
4. Manila Municipal Water System
5. Clay Basin Camp (Questar Pipeline Company)

DUCHESNE COUNTY
6. Duchesne Water System
7. Myton Municipal Water System
8. Johnson Water District
9. East Duchesne Improvement District
10. Duchesne County Upper Country WID
11. Fruitland Water Special Service District
12. Roosevelt Municipal Water Systems
13. Neola Water District
14. Tabiona Water System
15. Valley Park Trailer Court
16. Fruitland Homeowners
17. Central Utah Water Conservancy District-Duchesne
18. Pinion Forest Service District
19. Hanna Water and Sewer District

UINTAH COUNTY
20. Ashley Valley Water & Sewer Impr. District
21. Jensen Water Improvement District
22. Maeser Water Improvement District
23. Vernal Municipal Water System
24. Tridell-Lapoint Water Improvement District
25. Ute Indian Tribe Water System
26. Ballard Water Improvement District
27. Ouray Park Water Improvement District
28. Central Utah Water Conservancy District-Ashley



In an extreme emergency where danger to public health is imminent, the scope and nature of the threat must be reported to the DDW. Upon receiving a report of a significant decline in the quality of a public water supply, the division will direct necessary action to immediately eliminate the initial and ongoing cause of the problem. System operating policies are then revised to prevent similar problems from occurring in the future.

The Utah Safe Drinking Water Act (USDWA) created the Utah Drinking Water Board. The act has the power to regulate and protect the quality of Utah's drinking water. The USDWA authorizes rules designed to: 1) establish standards for drinking water quality; 2) establish standards and regulations for the design and construction of new and expanded water treatment and conveyance facilities; 3) protect watersheds and other sources of raw public water supplies; 4) provide technical and financial assistance to train operators, construct new treatment and distribution facilities and renovate existing ones; 5) administer federal programs that provide technical and financial assistance to local water agencies; 6) carry out emergency plans when natural disasters contaminate public drinking water supplies; and 7) provide enforcement of state and federal drinking water regulations.

State safe drinking water rules at a minimum reflect the same standards as federal regulations. State rules can be more stringent than federal regulations where the Board and Division of Drinking Water find federal regulations do not adequately protect the health of people in a certain area.

Maximum contaminant levels (MCLs) have been established by the DDW in setting treatment standards. MCLs have been established to protect primary and secondary standards and trigger treatment processes when the MCLs are exceeded. Primary standards apply to water constituents to protect public health and safety, while secondary standards apply to the water constituents of an aesthetic nature such as taste and odor. Federal secondary constituents' standards for some contaminants (e.g., sulfate, total dissolved solids) are deemed so important that they are regulated as primary standards under USDWA. State primary standards must be followed by all public drinking water systems. State secondary standards, however, are only recommended to water systems and a means to ensure consumer satisfaction with delivered water quality.

The DDW also administers and promotes other programs. Funding is provided from a state revolving fund to construct new treatment and distribution facilities or upgrade existing facilities. Construction funds are awarded in four ways: 1) low interest loans, 2) direct grants, 3) interest buy-downs and 4) credit enhancements.

A Drinking Water Source Protection Plan is required of all water systems for submission to the DDW for general review and assessment of compliance with state drinking water rules.

11.3.3 Federal

With passage of the federal Safe Drinking Water Act (SDWA) in 1974, the federal government established national drinking water regulations to protect the public health from waterborne diseases. Congress expanded and strengthened the SDWA in 1986. The amended SDWA significantly increased the responsibility of the Environmental Protection Agency (EPA) to: 1) establish maximum levels of contamination for established pollutants, 2) set deadlines for owners/operators of treatment facilities to comply with federal regulations, 3) regulate lead and copper source protection and 4) strengthen enforcement of all regulations in the act. Chemical, physical, radiological and bacteriological substances in drinking waters that pose a health risk to the public are regulated by the EPA under provisions in the SDWA. The EPA has established MCLs for drinking water. An extensive list of MCLs has been established for the most common inorganic and organic contaminants. In addition, the SDWA established a strict schedule for the EPA to set MCLs for additional contaminants. As a result, additional contaminants are regularly identified and subjected to new state-established regulations.

To control the aesthetic quality of drinking water supplies, the SDWA establishes a list of secondary maximum contamination levels (SMCLs). SMCLs were established to ensure compliance with taste, odor and color standards.

The SDWA also requires state and local water providers monitor a specified list of regulated and

unregulated contaminants. Selection of contaminants is dependent on the number of people served, the water supply source and the contaminants likely to be found. The standardized monitoring framework is administered over three, three-year compliance cycles, for a nine-year total monitoring period, beginning in 1992. Completion of the first nine-year monitoring period will be followed by a second nine-year period.

The 1986 SDWA amendments also require all states to develop wellhead protection programs. The DDW has created the Drinking Water Source Protection Rule (DWSPR) outlining the general requirements to protect wellheads from outside surface contamination. Requirements of the DWSPR include preparing a Drinking Water Source Protection Plan for each groundwater source in all public water systems. Proof of ownership, and maintenance of all land in and around wellheads where surface water contamination can occur, is also required.

Through the 1996 Reauthorized Safe Drinking Water Act (SDWA), the Drinking Water Board is receiving funding to establish a Drinking Water State Revolving Fund (SRF). The purpose of the fund is to ensure all drinking water systems within the state are capable of maintaining and protecting the supply of drinking water at an affordable cost. The Drinking Water Board expects to receive grants, a portion of which will go into the SRF for project construction. The amounts for project construction are: $9.76 million in 1998, $6.0 million in 1999, $6.5 million in 2000, and between $6.0 million and $6.5 million each year through 2003. The state is expected to provide an additional 20 percent of each appropriation, or a total $9.8 million, as matching cost-share funds. The Drinking Water Board will have another portion of the grants available for regional water system planning.

The EPA must publish a maximum contaminant level goal (MCLG) and promulgate a National Primary Drinking Water Regulation (NPDWR) for contaminants that: 1) may have adverse effects on human health, 2) are known or are likely to occur in public water systems at a frequency and concentration of significance to public health, and 3) whose regulation offers a meaningful opportunity to reduce health risk for people served by public water systems.

The EPA must issue regulations establishing criteria for a monitoring program for unregulated contaminants. The regulations specify that only a representative sample of systems serving 10,000 or fewer people are monitored. By August 6, 1999, and every five years thereafter, the EPA must issue a list of no more than 30 unregulated contaminants to be monitored by public water systems and included in the occurrence database.

A new program is established authorizing the EPA to provide grants to states for the development and implementation of state programs to ensure the coordinated and comprehensive protection of groundwater resources within the state.

11.4 Drinking Water Problems

Demand for high quality water and the potential for contamination of supplies has increased along with population growth. Natural geologic conditions, as well as human activities such as agriculture, mining, construction and hazardous waste spills, all contribute to drinking water problems. Contamination also comes from watershed and alluvial fan recharge areas where polluted recharge waters enter underground drinking water aquifers.

11.4.1 Operation of Facilities

Water quality in the upper reaches of the basin is good to excellent. Occasional repair, replacement, enlargement or upgrading of each system is required to maintain adequate levels of service. Investments in wells, storage tanks, treatment plants and pipelines can be expected in the future.

11.4.2 Groundwater Contamination

Most groundwater is acceptable for use in municipal, industrial and agricultural operations with only a few restrictions in isolated areas of poorer quality. Industries such as the phosphate mining, oil and gas production, and gilsonite mining use well and spring water in their operations.

11.5 Culinary Water Use and Projected Demands[57]

Population projections are presented in Section 4 and are used to forecast M&I water needs. Most public water suppliers expect an increased demand throughout the projection period to the year 2020. Water use and projected demands on major public drinking water systems, including most commercial and some industrial uses, are shown in Table 11-2.

Table 11-2
Current Projected Culinary Water Diversions For Major Public Water Systems

Location of Use (County)	1995	2020	2050
	(acre-feet/year)		
Daggett	510	790	1,220
Duchesne	2,820	3,800	5,120
Uintah	6,270	8,920	12,690
Totals	9,600	13,510	19,030

These culinary M&I water projections do not include effects of demographic changes in persons per household or water conservation measures. If the projected downward trend in persons per household continues, it will increase the projected water use per person about 4 percent by the year 2050. This occurs because some water uses, especially outdoor lawn and garden irrigation, remain constant as household size is reduced. Water conservation is discussed in Section 17.

11.5.1 Water Treatment

Federal regulations and state rules require that surface water supply for culinary use has multiple barriers against waterborne disease transmission. The most common treatment is a dual-barrier process of water filtration and subsequent chemical disinfection with chlorine. Well and spring waters require no treatment when free of surface water influence, but many water systems nevertheless implement disinfection as a precaution. All surface water delivered for culinary use is treated. Well water requires no treatment in most cases. Spring water is usually chlorinated. Table 11-3 lists the treatment methods in this basin. Where applicable, maximum system hydraulic capacities are also indicated. Figure 11-3 shows the location of culinary treatment facilities.

11.5.2 Water Supply and Use

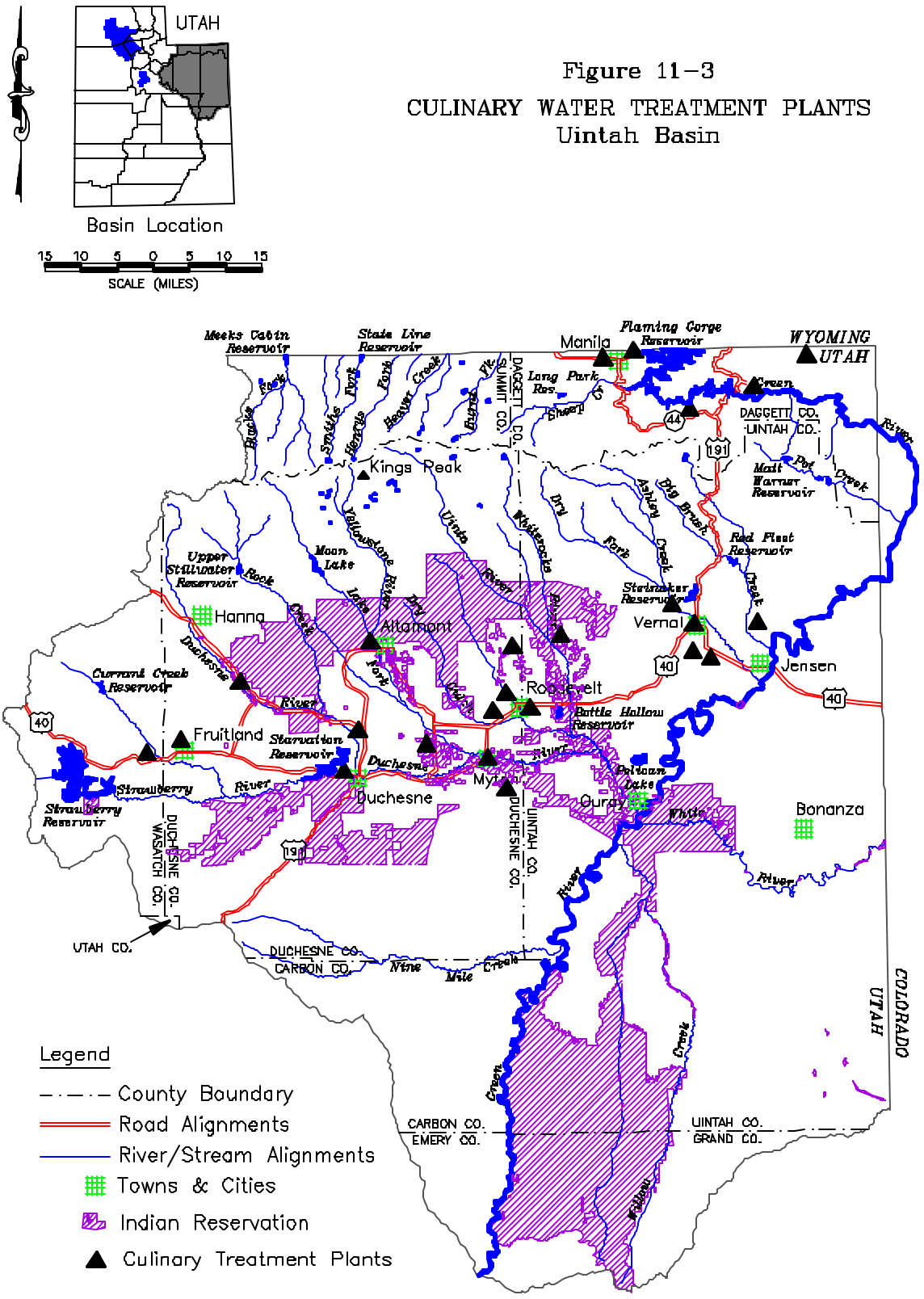
As of 1995, culinary treatment and distribution systems provide drinking water to about 35,800 people in the basin. The balance of the population is served by several or single-family domestic systems.

Table 11-4 shows the population served, total connections and use, and per capita use rates. Total culinary water use is expected to increase from about 9,600 acre-feet in 1995 to 19,030 acre-feet by 2050. Culinary water supply wells and springs are shown in Figure 11-4.

Monthly water rates in the Uintah Basin range from $12 per 10,000 gallons in Vernal to $35 in East Duchesne. Water rates for selected communities are shown in Section 17.

11.6 Issues and Recommendations

Drinking water issues revolve around water quality and the protection from contamination by untreated wastewater and treated wastewater effluent, and by poor land use practices of streams, reservoirs and groundwater aquifers. These issues are discussed in other sections of the *State Water Plan*. Section 12 deals with water quality in streams and reservoirs and Section 19 addresses groundwater issues. ❑


UTAH
Basin Location
15 10 5 0 5 10 15
SCALE (MILES)
Figure 11-3
CULINARY WATER TREATMENT PLANTS
Uintah Basin
Meeks Cabin Reservoir
State Line Reservoir
Manila
Flaming Gorge Reservoir
WYOMING
UTAH
Kings Peak
Long Park Res.
Sheep Cr.
DAGGETT CO.
SUMMIT CO.
DAGGETT CO.
UINTAH CO.
Green River
Brush Creek
Smiths Fork
Henrys Fork
Beaver Creek
Burnt Fk.
Dry Fork
Ashley Creek
Big Brush Creek
Red Fleet Reservoir
Matt Warner Reservoir
Pot Creek
Upper Stillwater Reservoir
Moon Lake
Yellowstone River
Uinta River
Whiterocks River
Steinaker Reservoir
Hanna
Altamont
Vernal
Jensen
Roosevelt
Currant Creek Reservoir
Duchesne River
Battle Hollow Reservoir
Fruitland
Starvation Reservoir
Myton
Pelican Lake
Ouray
Bonanza
White River
Strawberry Reservoir
Strawberry River
Duchesne
DUCHESNE CO.
WASATCH CO.
UINTAH CO.
UTAH CO.
DUCHESNE CO.
CARBON CO.
Nine Mile Creek
Green River
Willow Creek
Hideout
CARBON CO.
EMERY CO.
UINTAH CO.
GRAND CO.
COLORADO
UTAH
40
191
44
Legend
County Boundary
Road Alignments
River/Stream Alignments
Towns & Cities
Indian Reservation
Culinary Treatment Plants

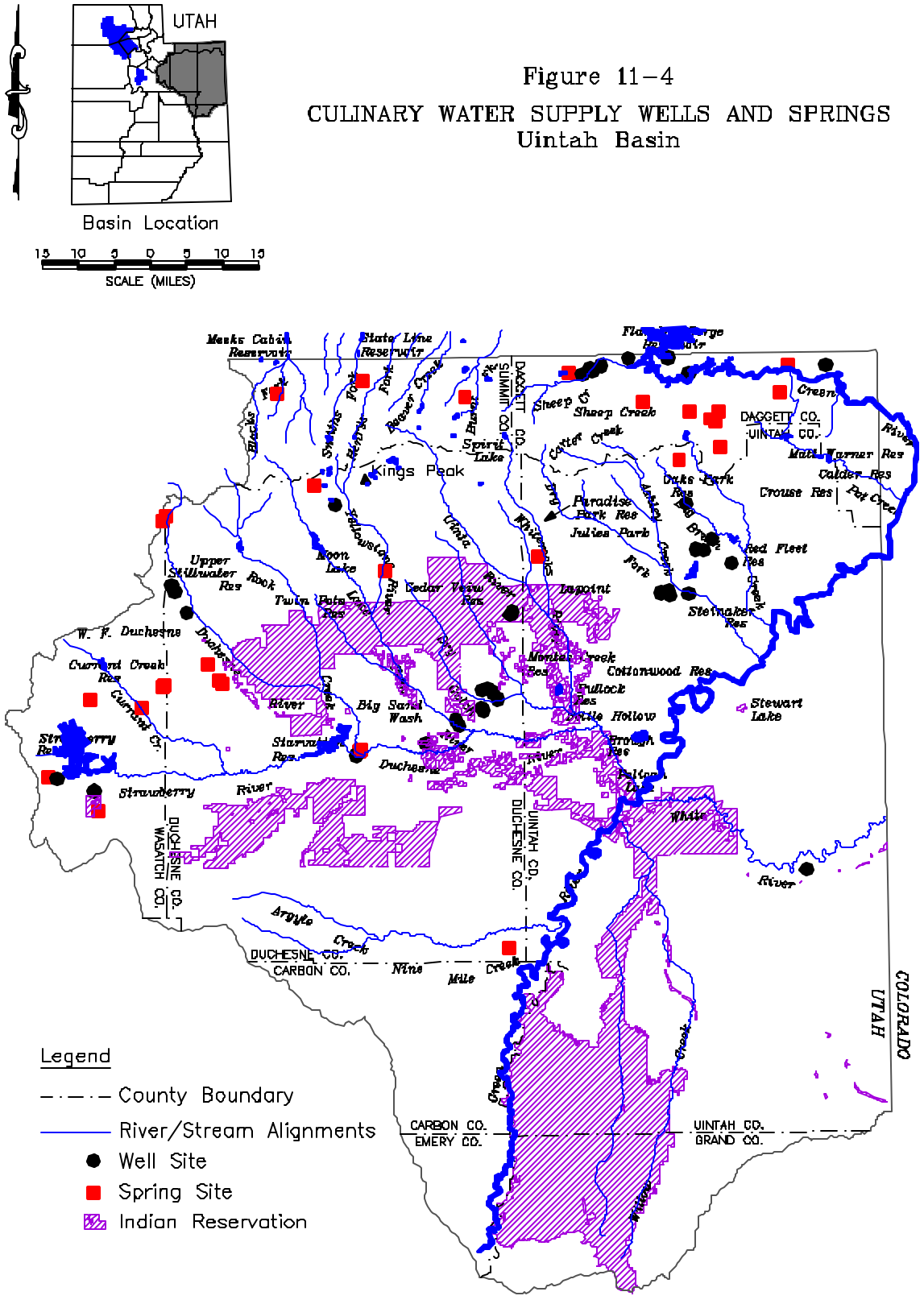


Figure 11-4

CULINARY WATER SUPPLY WELLS AND SPRINGS
Uintah Basin

Table 11-3
Water Treatment Facilities

Facility Name	Treatment Method	Source	Max. Ac-ft/yr
Daggett County			
Dutch John (Bureau of Reclamation)	F/C	Surface	677
Daggett County Water & Sewer	C	Springs(1)/Wells(1)	121
Greendale Water Company	C	Springs(2)	116
Manila Municipal Water System	F/C,P/C	Springs(2)/Wells(4)/Surface	652
Clay Basin Camp(Questar Pipeline Co.)	C, F/C	Springs(2)/Wells(4)/Surface	6
Daggett County Total			1,572
Duchesne County			
Johnson Water District	None	Wells(1)	1,290
Duchesne County Upper County W.C.D.	C	Springs(2)	3
Fruitland Water Special Service District	C	Springs(2)	68
Roosevelt Municipal Water System	C	Wells(5)	
Roosevelt Municipal Water System			7,147
Neola Water District			130
Tabiona Water System	C	Springs(2)	194
Valley Park Trailer Court	C	Wells(1)	565
Fruitland Homeowners	C	Well(1)	1
Central Utah W.C.D. - Duchesne (4 mgd, 4481 ac-ft/yr)	F/C	Surface	
Duchesne County Water System			210
Myton Municipal Water System			87
Johnson Water District			816
East Duchesne Improvement District			181
Reserve Capacity			3,187
Duchesne County Total			12,584
Uintah County			
Ashley Valley Water & SID (8 mgd, 8962 ac-ft/yr)			
Ashley Valley Water & SID	F/C	Surface	1,864
Maeser Water Improvement District			590
Jensen Water Improvement District			250
Reserve Capacity			6,258
Central Utah W.C.D. - Ashley Filtration Plant (15 mgd)	F/C	Surface	
Vernal City Municipal Water			2,800
Uintah W.C.D. (Wholesale to Ashley Valley)			30
Reserve Capacity			10,836
Tridell-Lapoint Water Improvement District	F/C	Surface	1,145
Ute Indian Tribe	C	Springs(1)/Wells(1)	
Ute Indian Tribe			2,398
Ouray Park Water Improvement District			42
Johnson Water District (Duchesne County)			20
Uintah County Total			26,233

Treatment Method: C=Chlorination, F/C=Filtration & Chlorination
Source: Utah Division of Drinking Water

Table 11-4
Public Community Systems Culinary Water Supply and Use - 1995

Location of Use (County)	Population Served	Total Connections	Total M&I Water[a,d] Use (ac-ft)	Per Capita[b] Use (gpcd)
Daggett	1,240[c]	830[c]	510	366
Duchesne	11,280	3,930	2,820	223
Uintah	23,260	7,670	6,270	240
Totals	35,780	12,430	9,600	240[e]

[a]Includes residential, commercial, institutional and industrial culinary uses.
[b]From Table 11-5 Division of Water Resources M&I Study (March 1997).
[c]High due to summer tourists, tourist homes and trailers.
[d]Does not include self-supplied industries.
[e]Average.

Contents

Section 12
Uintah Basin Plan

Utah State Water Plan

Water Quality

Surface water in the upper watersheds is of good quality and often suitable for culinary use only after disinfection for microbiological quality assurance. Quality of water deteriorates as it moves downstream.

12.1 Introduction

This section presents data and information on existing levels of water quality throughout the Uintah Basin. Sources of pollution are identified, problems and solutions are discussed, and a recommendation is given for control and improvement by responsible agencies.

12.2 Setting

The Uintah Basin Study Area includes the five hydrologic subareas as described in Section 3 and shown by Figure 3-2.

12.3 Organizations and Regulations

Maintaining water quality requires the cooperation of a wide range of public and private interests. The responsibility for providing leadership falls mostly on local government agencies, subject to state and federal regulatory programs.

12.3.1 Local

Towns, cities and counties have primary responsibility for water pollution control within their jurisdiction. These responsibilities and authorities are contained in Section 10, 11, 17, 19 and 73 of the *Utah Code Annotated, 1953, Amended* (UCA). The Tri-County Health Department, with an office in Vernal, has significant jurisdiction over many aspects of pollution control in the Uintah Basin. City and county government water and health agencies also have responsibility to follow and enforce state laws and rules in the operation of their facilities.

The locally led Dinosaurland Resource Conservation and Development Council (RC&D) currently participates with the Utah Division of Water Quality in a watershed study to improve water quality in the Uintah Basin. Table 12-1 shows the major wastewater treatment facilities operated by local agencies.

Lower Ashley Creek

12.3.2 State Department of Environmental Quality

Under the Utah Water Quality Act, the Division of Water Quality (DWQ) of the Department of Environmental Quality (DEQ) and the Utah Board of Water Quality are responsible for adopting, enforcing

Table 12-1
Wastewater Treatment Facilities

City	Type	Disposal Method	Design Capacity (ac-ft/day)	Current Average Flow (mgd)	Volume (ac-ft/ day)
Daggett County					
Dinosaur Nat'l Monument	Lagoon	TC	0.03	0.005	0.02
Dutch John	"	TC	0.50	0.162	0.50
Flaming Gorge	"	TC	0.25	0.003	0.01
Manila	"	TC	0.12	0.082	0.25
Duchesne County					
Altamont	Lagoon	TC	0.05	0.02	0.06
Duchesne	"	FDL	0.42	0.18	0.55
Myton	"	TC	0.17	0.10	0.03
Roosevelt	"	LWLA	0.12	0.20	0.61
Tabiona	"	TC	0.04	0.03	0.09
Neola	"	FDL	0.07	0.16	0.49
Uintah County					
Bonanza Plant	Lagoon	TC	0.03	0.009	0.03
Ashley Valley	"	LWLA	3.9	2.76	8.47

Note: TC = Total Containment Lagoon
LWLA = Lagoon with Land Application
FDL = Facultative Discharging Lagoon

and administering state (Utah Water Quality Act, *UCA 19-5*) and federal (Clean Water Act) water quality regulations. Their charge is to maintain acceptable levels of water quality. The DWQ monitors rivers, streams, lakes and groundwater for adherence to water quality standards.

The Clean Water Act gives responsibility to the state DEQ for the enforcement of federal regulations dealing with point source discharges. These federal regulations state: "... the discharge of any pollutant directly into the waters of the United States from a new or existing point source is prohibited unless the point source has a valid and active National Pollutant Discharge Elimination System (NPDES) permit."

Limits on loading rates of various pollutants are established by state agencies with consideration given to EPA regulations. However, state agencies can adopt more stringent rules. Wastewater treatment plants and/or industrial businesses discharging pollutants into Utah waters are issued a Utah Pollutant Discharge Elimination System (UPDES) permit. These permits are valid for five years and must be renewed with a reevaluation of pollutant limitations. Enforcement of NPDES/UPDES permit requirements is accomplished by effluent monitoring programs supervised by the Division of Water Quality.

The Clean Water Act also assigns responsibility for the Non-Point Source Program (NPS), Section 319(b), to DWQ. This is implemented with collaboration from the Utah Department of Agriculture and Food and the Utah Soil Conservation Commission.

The Division of Water Quality developed a *Ground Water Quality Protection Strategy* for the State of Utah based on an executive order issued in 1984 by the Governor. Groundwater discharge permits are required for activities that may affect these waters.

Department of Agriculture and Food - The Environmental Quality Section of the Utah

Department of Agriculture and Food implements Utah's non-point water pollution control and prevention program administered by the Division of Water Quality. This is partially funded through federal grants from the Environmental Protection Agency(EPA) and partially supported by matching funds from state and local agencies and private sources. The program is divided into three parts: watershed management projects, groundwater and surface monitoring, and information and education. Public information programs use newsletters, brochures, videos and slide shows, and target public schools and adult education programs.

The Utah Board of Water Quality has also established stream and reservoir classifications.[153] Table 12-2 shows the current water quality classes and classification of streams for the major water storage facilities. Table 12-3 shows the classification of streams in the Uintah Basin.

12.3.3 Federal[63,64]

Congress passed the federal Water Pollution Control Act in 1972 to establish regulatory programs to improve the quality of the nation's waters. The act was amended in 1977 and became known as the Clean Water Act (CWA). Additional amendments were made in 1987.The CWA amendments provide regulations to deal with the growing national toxic water pollutant problem and further to refine the EPA's enforcement priorities. The amendments substantially increased the EPA's authority to enforce all water quality regulations associated with new federal mandates to clean up the nation's streams, rivers, reservoirs and lakes.

In the mid-1950s, the federal government began offering funding programs to state water pollution control agencies to help in the ongoing construction of wastewater treatment facilities. These early grants provided funding to pay for 30 to 55 percent of the total construction costs. This source of federal funds, along with monies provided through the Utah Water Pollution Control Act, (UWPCA), helped to finance most wastewater treatment facilities in the state.

From 1972 to 1989, more than $14.5 million in EPA grants were spent to construct or enlarge wastewater treatment and collection facilities throughout the Uintah Basin. Towns, cities, rural communities and some sewer improvement districts have benefitted from this federal funding.

Federal expenditures for public works drastically decreased by 1990 and most grant programs for construction and upgrades were eliminated. Wastewater treatment funding now is only available through programs administered by the Division of Water Quality (DWQ). Expenditures in the Uintah Basin have averaged $1.6 million per year for new construction over the last several years.

Federal standards for solid waste and hazardous material are set forth under the Comprehensive Environmental Response and Comprehensive Liability Act (CERCLA). These standards are regulated by the EPA, and compliance is verified through local health department monitoring programs.

12.4 Water Quality Programs

Surface and groundwater quality is determined by the contaminants discharged from point and non-point discharges to receiving streams and aquifers. Point source problems arise from effluent discharges from wastewater treatment facilities and industrial processing plants. Non-point pollution is surface runoff generated from agricultural, municipal and industrial activities, erosion and other natural processes, and many other categories. Runoff entering surface streams from urban development is no longer considered non-point source discharge and is subject to UPDES regulations. Sewage discharge from watercraft is also a significant water quality problem.

12.4.1 Surface Water

The most recently completed surface water quality evaluation of the Uintah Basin is the *Uinta Watershed Management Unit-Stream Assessment*, by the Utah Division of Water Quality of the Department of Environmental Quality, October 1997. Substantial material from that report is reported herein either verbatim or in an abbreviated form.

Data collected from 102 sampling sites were used to assess the water quality of streams in the study area. Fifty-two of these were monitored by the Utah Division of Water Quality on an intensive basis

Table 12-2
Surface Water Classifications of Reservoirs

Lakes	Classes			
Strawberry Reservoir	1C	2A	3A	4
Starvation Reservoir	1C	2A	3A	4
Currant Creek Reservoir	1C	2A	3A	4
Upper Stillwater Reservoir	1C	2A	3A	4
Steinaker Reservoir	1C	2A	3A	4
Red Fleet Reservoir	1C	2A	3A	4
Flaming Gorge Reservoir	1C	2A	3A	4
Big Sand Wash Reservoir	1C	2A	3A	4
Moon Lake	1C	2B	3A	4

1C Protected for domestic purposes with prior treatment by processes as required by the Utah Department of Health.
2A Protected for primary contact recreation such as swimming.
2B Protected for secondary contact recreation such as boating, wading, or similar uses.
3A Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
3B Protected for warm water species of fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
3D Protected for waterfowl, shore birds and other water oriented wildlife not included in 3A, 3B, or 3C including the necessary aquatic organisms in their food chain.
4 Protected for agricultural uses including crop irrigation and stock watering.

from March 1995 to June 1996. Samples were collected every two weeks during spring runoff in 1995 and 1996 and then monthly except for December 1995 at these stations. Data from samples collected by the U. S. Forest Service at 12 sites on tributary streams to Strawberry Reservoir and one below the reservoir, and an additional 25 samples collected by the Forest Service on the north slope of the Uinta Mountains, were used to assess streams on these federal lands. The USFS data were collected from May 1992 to November 1996. To further supplement data collection, the Bureau of Land Management (BLM) collected samples at 12 sites during 1995 and 1996.

Data Analysis - All water quality sample data and field data were entered into the Division of Water Quality's database and compared against the state's water quality standards. Because of a change in the method of assessing the impacts of nutrients, those waters that had elevated levels of phosphorus were identified. If there were no additional data to determine if water quality impairments had occurred, these elevated phosphorus waters were not listed on the 303(d) list, Table 12-4. However, they were identified as needing further study.

Results - This study area has an estimated 3,536 perennial stream miles, including the main stem Green River. An assessment of water quality beneficial-use support was made on 2,834 miles (80 percent) of the total stream miles. Of these, 2,208 miles were assessed as fully supporting all of their beneficial uses, 240 miles were assessed as partially supporting, and 386 miles were assessed as

Table 12-3
Surface Water Classifications of Streams

Streams	Classification			
Green River, Flaming Gorge Reservoir to Headwater	2B	3A		4
Green River, Flaming Gorge Reservoir to Yampa River	2B	3A		4
Green River below Yampa River	2B	3B	3D	4
Ashley Creek above Steinaker Reservoir Diversion	2B	3A		4
Ashley Creek below Steinaker Reservoir Diversion	2B	3A		4
Brush Creek above Red Fleet Reservoir	2B	3A		4
Brush Creek below Red Fleet Reservoir	2B	3B		4
Whiterocks River above confluence with Uinta River	2B	3A		4
Uinta River above confluence with Whiterocks River	2B	3A		4
Uinta River below confluence with Whiterocks River	2B	3A		4
Yellowstone River above Crystal Ranch	2B	3A		4
Yellowstone River below Crystal Ranch	2B	3A		4
Lake Fork River above Moon Lake	2B	3A	3D	4
Lake Fork River below Moon Lake	2B	3A	3D	4
Rock Creek above Upper Stillwater Dam	2B	3A		4
Rock Creek below Upper Stillwater Dam/	2B	3A		4
Water Treatment Plant	1C			
Duchesne River above confluence with Rock Creek	2B	3A		4
Duchesne River above confluence with Strawberry River	2B	3B		4
Duchesne River below confluence with Strawberry River	2B	3A		4
Strawberry River above Strawberry Reservoir	2B	3A	3D	4
Strawberry River below Strawberry Reservoir	2B	3A		4
Sheep Creek above Flaming Gorge Reservoir	2B	3A		4
Henrys Fork above Flaming Gorge Reservoir	2B	3A		4
Smiths Fork above Stateline Reservoir	2B	3A		4
Blacks Fork above Meeks Cabin Reservoir	2B	3A		4
White River above confluence with Green River	2B	3B		4
Indian Creek above confluence with Duchesne River	2B	3B		4
Pot Creek above confluence with Green River	2B	3B		4
Beaver Creek above Wyoming state line	2B	3A		4
Birch Creek below Wyoming state line	2B	3A		4
Burnt Creek above Hoop Lake	2B	3A		4
Carter Creek above Flaming Gorge Reservoir	2B	3B		4
Lodge Pole Creek above Sheep Creek	2B	3B		4

Classification description shown in Table 12-2.

nonsupporting at least one beneficial use. In addition, 497 stream miles were identified as needing further evaluation because high concentrations of total phosphorus preliminarily preclude determination of whether or not their beneficial uses are being supported. The major causes of impact were total dissolved solids, temperature and habitat alterations. Aquatic wildlife and agricultural use were the two principal beneficial uses that indicated impairment. The major sources of impairment were agricultural activities, habitat modification and hydrological modification.

Table 12-4 [303(d) List]
Beneficial Use Assessment for Water Bodies Located in the Uintah Watershed Management Area

Water Body Name	Water Body Description	Stream Miles	Miles Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting
GREEN RIVER/ FLAMING GORGE						
Green River-3	Green River and some tributaries from Utah-Colorado state line to Flaming Gorge Reservoir.	58.74	58.74	58.74	0	0
Red Creek	Red Creek-tributaries, confluence Green River to headwaters.	13.95	0	-	-	-
Spring Creek		3.47	0	-	-	-
Birch Spring Draw	Birch Spring Draw-tributaries, Flaming Gorge Reservoir to headwaters.	17.16	0	-	-	-
Florence Creek	Florence Creek-tributaries, confluence Green River to headwaters	16.35	16.35	0	16.35	16.35
Goslin Creek	Goslin Creek-tributaries, confluence Green River to headwaters.	3.54	0	-	-	-
Blacks Fork #1		2.47	2.47	2.47	0	0
O-Wi-Yu-Kuts Creek	O-Wi-Yu-Kuts Creek-tributaries, confluence Willow Creek to Utah-Colorado state line.	2.05	0	-	-	-
Sheep Creek	Sheep Creek-tributaries, Flaming Gorge Reservoir to headwaters.	70	70	70	0	0
Gorge Creek	Gorge Creek-tributaries, confluence Green River to headwaters.	8.16	0	-	-	-
Pot Creek	Pot Creek-tributaries, Crouse Dam to headwaters.	21.98	0	-	-	-
Burnt Fork Creek	Burnt Fork Creek-tributaries, Utah-Wyoming state line to headwaters.	36.52	36.52	36.52	0	0
Middle Fork Beaver Creek	Middle Fork Beaver Creek-tributaries, Utah-Wyoming state line to headwaters.	30.06	30.06	30.06	0	0
West Fork Beaver Creek	West Fork Beaver Creek, Spring Creek, Poison Creek-tributaries; Utah-Wyoming state line to headwaters.	26.72	26.72	26.72	0	0

Table 12-4 [303(d) List] (Continued)
Beneficial Use Assessment for Water Bodies Located in the Uintah Watershed Management Area

Water Body Name	Water Body Description	Stream Miles	Miles Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting
Henrys Fork River	Henrys Fork River-tributaries, Utah-Wyoming state line to headwaters.	35.54	35.54	35.54	0	0
Dahlgreen Creek	Dahlgreen Creek-tributaries, Utah-Wyoming state line to headwaters.	8.54	8.54	8.54	0	0
Sears Creek	Sears Creek-tributaries, confluence Green River to headwaters.	6.99	6.99	6.99	0	0
Flaming Gorge Reservoir Tributaries	All other tributaries to Flaming Gorge Reservoir not listed separately.	55.64	0	-	-	-
Birch Creek-tribs	Birch Creek-tributaries, Utah-Wyoming state line to headwaters.	9.91	9.91	0	0	0
Cart Creek	Cart Creek and tributaries.	16.84	0	-	-	-
Carter Creek	Carter Creek-tributaries, Flaming Gorge Reservoir to headwaters.	90.12	0	-	-	-
Eagle Creek	Eagle Creek-tributaries, Flaming Gorge Reservoir to headwaters.	8.59	0	-	-	-
Willow Creek	Willow Creek-tributaries, from confluence Green River to headwaters (Daggett Co.).	16.37	0	-	-	-
Jackson Creek	Jackson Creek-tributaries, confluence Green River to headwaters.	10.93	0	-	-	-
Goslin Creek	Goslin Creek-tributaries, confluence Green River to headwaters.	3.87	0	-	-	-
Lower Pot Creek	Pot Creek-below reservoirs to Utah-Colorado state line.	0	0	-	-	-
BLACKS FORK						
Blacks Fork	Blacks Fork River-tributaries, Utah-Wyoming state line to headwaters; all other streams from eastern boundary of Blacks Fork River Drainage to the West Boundary of Bear River Drainage.	132.28	132.28	132.8	0	0
Archie Creek	Archie Creek-tributaries, from Utah-Wyoming state line to headwaters	4.72	4.72	4.72	0	0

Table 12-4 [303(d) List] (Continued)
Beneficial Use Assessment for Water Bodies Located in the Uintah Watershed Management Area

Water Body Name	Water Body Description	Stream Miles	Miles Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting
Little West Fork	Little West Fork, Utah-Wyoming state line to headwaters.	3.8	3.8	3.8	0	0
East Fork Smiths Fork	East Fork Smiths Fork-tributaries, Utah-Wyoming state line to headwaters.	48.43	48.43	48.43	0	0
Gilbert Creek	Gilbert Creek-tributaries, Utah-Wyoming state line to headwaters.	6.68	6.68	6.68	0	0
West Fork Smiths Fork	West Fork Smiths Fork-tributaries, Utah-Wyoming state line to headwaters.	19.32	19.32	19.32	0	0
LOWER WHITE RIVER						
White River	White River, confluence Green River to Utah-Colorado state line.	74.67	74.67	74.67	0	0
Evacuation Creek	Evacuation Creek-tributaries, confluence White River to headwaters.	0	0	-	-	-
Lower Bitter Creek	Bitter Creek-tributaries, confluence White River to start of perennial stream (excluding Sweetwater Creek).	0	0	-	-	-
Upper Bitter Creek	Bitter Creek-tributaries, upper portion that is perennial.	24.89	0	-	-	-
Sweetwater Creek	Sweetwater Creek-tributaries, confluence Bitter Creek to headwaters.	3.95	0	-	-	-
LOWER GREEN RIVER/DIAMOND MTN						
Green River-2	Green River, Utah-Colorado state line to Duchesne River confluence.	106.94	106.94	106.94	0	0
Pole Creek	Pole Creek	23.26	22.36	23.26	0	0
Jones Hole Creek	Jones Hole Creek-tributaries, confluence Green River to headwaters.	5.85	0	-	-	-

Table 12-4 [303(d) List] (Continued)
Beneficial Use Assessment for Water Bodies Located in the Uintah Watershed Management Area

Water Body Name	Water Body Description	Stream Miles	Miles Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting
Diamond Gulch	Diamond Gulch, near Jones Hole Creek to headwaters.	33.14	0	-	-	-
ASHLEY/BRUSH						
Lower Ashley Creek	Ashley Creek-tributaries, from confluence Green River Vernal Sewage Lagoons.	15.19	15.19	0	0	303(d) 15.19
Middle Ashley Creek	Ashley Creek-tributaries, from Vernal sewage lagoons to Dry Fork confluence.	4.19	4.19	4.19	0	0
Upper Ashley Creek	Ashley Creek-tributaries, confluence of Dry Fork to headwaters (exclude Dry Fork).	61.73	61.73	61.73	0	0
Dry Fork Creek	Dry Fork Creek-tributaries, confluence Ashley Creek to headwaters.	47.45	47.45	47.45	0	0
Brush Creek	Brush Creek-tributaries, confluence Green River to Red Fleet Dam, not including Little Brush Creek.	23.86	23.86	23.86	0	0
Lower Little Brush Creek	Little Brush Creek-tributaries, confluence Big Brush Creek to mouth of Little Brush Creek Gorge.	6.11	6.11	6.11	0	0
Upper Little Brush Creek	Little Brush Creek-tributaries, from mouth of Little Brush Creek Gorge to headwaters.	34.4	34.4	34.4	0	0
Big Brush Creek	Big Brush Creek-tributaries, Red Fleet Reservoir to headwaters.	41.9	41.9	41.9	0	0
DUCHESNE RIVER						
Duchesne River-1	Duchesne River-tributaries, confluence Green River to Randlett.	19.14	19.14	Nutrients 0.00	303(d) 19.14	0
Duchesne River-2	Duchesne River, Randlett to Myton.	31.82	31.82	Nutrients 0.00	303(d) 31.82	31.82
Duchesne River-3	Duchesne River, from Myton to Strawberry River confluence.	39.97	39.97	Nutrients 39.97	0	0
Duchesne River-4	Duchesne River, from Strawberry River confluence to West Fork Duchesne confluence.	67.28	67.28	Nutrients 67.28	0	0
West Fork Duchesne	West Fork Duchesne River to Duchesne River	67.26	67.26	67.26	0	0

Table 12-4 [303(d) List] (Continued)
Beneficial Use Assessment for Water Bodies Located in the Uintah Watershed Management Area

Water Body Name	Water Body Description	Stream Miles	Miles Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting
North Fork Duchesne	North Fork Duchesne River-tributaries, confluence Duchesne to headwaters	58.87	58.87	58.87	0	0
Indian Canyon	Indian Canyon and tributaries, confluence Duchesne River to headwaters.	44.38	44.38	0	0	303(d) 44.38
Antelope Creek	Antelope Creek and tributaries, confluence Duchesne River to headwaters.	31.38	31.38	0	0	303(d) 31.38
Dry Gulch Creek	Dry Gulch Creek-tributaries, confluence Duchesne River to headwaters.	87.67	87.67	Nutrients 0.00	0	303(d) 87.67
Zimmerman Wash	Zimmerman Wash, confluence Lake Fork River to headwaters.	0.07	0	-	-	-
Lake Fork-1	Lake Fork River-tributaries, confluence Duchesne River to Pigeon Water Creek confluence.	22.36	22.36	0	0	303(d) 22.36
Lake Fork-2	Lake Fork River-tributaries, Pigeon Creek confluence to Yellowstone River confluence (includes Yellowstone River and Pigeon Creek to USNF boundary).	30.87	30.87	0	303(d) 30.87	0
Lake Fork-3	Lake Fork River-tributaries, Yellowstone River confluence to Moon Lake.	35.35	35.35	35.35	0	0
Tributaries to Moon Lake.	Tributaries to Moon Lake.	122.32	122.32	122.32	0	0
Upper Yellowstone	Yellowstone River-tributaries, from USNF boundary to headwaters.	110.50	110/5	110.5	0	0
Upper Rock Creek	Rock Creek-tributaries, from USNF boundary to headwaters.	99.18	99.18	99.18	0	0
Lower Rock Creek	Rock Creek and tributaries, confluence	29.21	29.21	29.21	0	0
Uinta River-1	Uinta River-tributaries, confluence Duchesne River upstream about 9 miles.	8.82	8.82	0	0	303(d) 8.82
Uinta River-2	Uinta River, 9 miles upstream to change in beneficial use.	3.16	3.16	0	0	303(d) 3.16

Table 12-4 [303(d) List] (Continued)
Beneficial Use Assessment for Water Bodies Located in the Uintah Watershed Management Area

Water Body Name	Water Body Description	Stream Miles	Miles Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting
Uinta River-3	Uinta River-tributaries, beneficial use classification change to USFS boundary (excluding Whiterocks River).	75.42	75.42	0	303(d) 75.42	0
Uinta River-4	Uinta River-tributaries, from USFS boundary to headwaters.	85.7	85.7	85.7	0	0
Upper Whiterocks River	Whiterocks River-tributaries, Tridell Water Treatment Plant to headwaters.	83.78	83.78	83.78	0	0
Lower Whiterocks River	Whiterocks River, confluence Uintah River to Tridell Water Treatment Plant.	18.81	18.81	18.81	0	0
Deep Creek	Deep Creek-tributaries, confluence Uintah River to headwaters.	24.73	24.73	Nutrients 0.00	303(d) 24.73	0
STRAWBERRY RIVER						
Upper Strawberry	Strawberry River-tributaries, Strawberry Reservoir to headwaters.	52.52	52.52	52.52	0	0
Strawberry-3	Other tributaries to Strawberry Reservoir.	97.64	97.64	97.64	0	0
Strawberry River-3	Strawberry River, Current Creek confluence to Soldier Creek Dam.	21.79	21.79	21.79	0	0
Strawberry River-2	Strawberry River-tributaries, Starvation Reservoir to Avintaquin Creek confluence.	16.09	16.09	Nutrients 16.09	0	0
Starvation Tribs	Tributaries to Starvation Reservoir except	10.04	0	-	-	-
Strawberry River-1	Strawberry River, confluence Duchesne River	4.26	4.26	4.26	0	0
Upper Currant Creek	Tributaries to Current Creek Reservoir.	58.98	0	-	-	-
Middle Currant Creek	Current Creek-tributaries, Red Creek confluence to Current Creek Reservoir.	60.12	60.12	Nutrients 60.12	0	0
Upper Red Creek	Tributaries to Red Creek Reservoir.	15.53	0	-	-	-
Lower Red Creek	Red Creek-tributaries, confluence Current Creek to Red Creek Reservoir.	15.55	15.55	Nutrients 15.55	0	0

Table 12-4 [303(d) List] (Continued)
Beneficial Use Assessment for Water Bodies Located in the Uintah Watershed Management Area

Water Body Name	Water Body Description	Stream Miles	Miles Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting
Lower Currant Creek	Currant Creek-tributaries, confluence Strawberry River to Red Creek confluence.	4.74	4.74	Nutrients 4.74	0	0
Avintaquin Creek	Avintaquin Creek-tributaries, confluence Strawberry River to headwaters.	54.37	54.37	Nutrients 54.37	0	0
Willow Creek	Willow Creek-tributaries, confluence Strawberry River to headwaters.	17.47	0	-	-	-
Timber Canyon Creek	Timber Canyon Creek-tributaries, confluence Strawberry River to headwaters.	15.53	0	-	-	-
WILLOW CREEK						
Upper Willow Creek	Willow Creek-tributaries, near Meadow Creek confluence to headwaters.	122.75	0	-	-	-
Willow Creek	Willow Creek-tributaries, confluence Green River to Meadow Creek confluence (except Hill Creek).	57.54	57.54	0	303(d) 57.54	0
Hill Creek	Hill Creek-tributaries, confluence Willow Creek to headwaters.	81.73	0	-	-	-
LOWER GREEN RIVER/DESOLATION						
Green River-1	Green River, from cataloging unit boundary to Duchesne River Confluence.	121.4	121.4	121.4	0	0
Pariette Draw Creek	Pariette Draw Creek-tributaries, confluence Green River to headwaters.	54.13	54.13	0	0	303(d) 54.13
Nine Mile	Nine Mile Creek and tributaries., confluence Green River to headwaters.	118.89	118.89	0	303(d) 118.89	0
Upper Range Creek	Range Creek-tributaries, Range Creek Pumping Station to headwaters.	8.72	0	-	-	-
Middle Range Creek	Range Creek-tributaries, from water diversion to Range Creek Pumping Station.	15.98	0	-	-	-
Lower Range Creek	Range Creek-tributaries, confluence Green River to Rah diversion.	9.51	9.51	9.51	0	0

(-) = Insufficient Data d = 303(d) List of Impaired Water
Source: Division of Water Quality - Uintah Watershed Management Unit Stream Assessment Study (1997).

Table 12-4 shows those stream segments that were determined not to be supporting at least one of their designated beneficial uses. These are called "water quality limited segments" and are placed on a list called the "303(d) list of impaired waters." This list is submitted to EPA every two years and identifies those waters that are not meeting water quality standards or are assessed as not fully supporting one or more of their designated beneficial uses. Also identified in Table 12-4 are waters exceeding phosphorus indicators. Detailed data from 97 water bodies are also indicated there.

Green River/Flaming Gorge Area

The main stem Green River and all perennial tributaries to Flaming Gorge Reservoir in Utah were assessed to be fully supporting all of their beneficial uses.

Blacks Fork Area

All waters in Utah in this study area fully meet their beneficial use class.

Muddy Creek Area

Only a very small portion of the headwater to this stream occurs in Utah, and it was not assessed.

Lower White River Area

The White River was assessed as fully supporting all of its beneficial use classifications. Evacuation Creek, an intermittent and often saline stream, could be a significant source of total dissolved solids entering the White River under certain conditions. Sample concentrations exceeded the state standard in 18 of the 19 TDS samples analyzed. The mean concentration was 3,041 mg/l.

High concentrations of total dissolved solids were also observed in Bitter Creek as well as its tributary, Sweetwater Creek. Neither of these streams was assessed because the streams were coded as intermittent.

Lower Green River/Diamond Mountain Area

The main stem Green River meets all standards. All tributary streams in this study area that were assessed fully met their beneficial standards.

Ashley/Brush Area

Ashley Creek - Because of selenium, TDS levels and agricultural activities, the lower 16 miles of Ashley Creek were found not to meet its beneficial use standards. This stream segment also has a fish consumption advisory on it because of the elevated levels of selenium found in fish tissue. Irrigation return flows probably add to the elevated concentrations of total dissolved solids and selenium in this segment. Several point sources discharge high concentrations of total dissolved solids into Union Canal and then flows into the creek.

Brush Creek was assessed as meeting all of its beneficial use standards.

Duchesne River Area[60,68]

Portions of the main stem of the Duchesne River were assessed as partially supporting its beneficial uses. High concentrations of total dissolved solids (TDS) were the reason for assessing the Duchesne River from its confluence with the Green River to Myton as only partially supporting its agricultural classification (Class 4). The segments in this section also had high levels of total phosphorus in the Strawberry River confluence area. The primary source of the high salinity and total phosphorus was attributed to irrigation return flows. The remainder of the Duchesne River, from Myton to the confluence of the West Fork of the Duchesne River, had high concentrations of total phosphorus.

Lake Fork River from its confluence with the Duchesne River to the Pigeon Water Creek confluence was assessed as not supporting its cold water game fish classification (Class 3A). According to the Central Utah Project Report (1995), high temperatures and silt were the causes of an impaired fishery habitat in this section. The report listed the sources as hydrological modification, habitat modification and return irrigation flows. The segment of stream from the Pigeon Creek confluence to the Yellowstone River confluence was assessed as partially supporting its Class 3A beneficial use. Habitat alteration caused

by hydrological shifting of the stream was listed as the cause and source of the impacts for this stream segment (CUP, 1995). The upper segments of Lake Fork River and its tributaries were assessed as fully supporting all of their beneficial uses.

Zimmerman Wash, depending on the flow, could be a significant contributor of total dissolved solids (TDS) and nutrients to the lower portion of Lake Fork River. The TDS concentrations exceeded the state standard in about 45 percent of the samples. Zimmerman Wash was not assessed because it is an intermittent stream.

Upper Duchesne River

Dry Gulch and Cottonwood creeks, including their tributaries, were assessed as not supporting their agricultural classification. High levels of total dissolved solids exceeded the state standard for agriculture usage in almost 50 percent of the samples. The mean concentration was 1,807 mg/l. This area has significant irrigation return flows, grazing and, according to the NRCS (1997), there may be some natural contribution of salinity to these streams in this area.

Antelope Creek was assessed as not supporting its agricultural use. It was also identified as having high levels of total phosphorus. Irrigation return flows, grazing and habitat alteration are thought to be the most significant sources of total dissolved solids and total phosphorus in the creek.

The lower nine miles of the Uinta River were assessed using water quality data collected from the CUP report (1995). It was assessed as not supporting its agricultural and aquatic life classifications (Class 3B). Salinity (TDS) exceeded the state standard in eight of the 19 samples collected. Temperature and sediment were listed in the CUP report as major impactors of the fishery. Sources of adverse impacts on the stream were irrigation return flows and hydrological modification of the stream channel. About three more miles of the Uinta River above this segment were assessed as partially supporting the 3B classification but not supporting agriculture usage. The remainder of the Uinta River upstream to the National Forest Boundary was assessed as only partially supporting its cold water game fish classification. The cause was listed as habitat modification, and the source was stream channel modification. The upper portion of the Uinta River was assessed as fully supporting all of its beneficial uses.

Canals

The water quality in several canals was evaluated to determine if it may be contributing pollutants to lakes and reservoirs as well as streams in the area.

Dry Gulch "C" Canal - Data collected above Big Sand Wash Reservoir indicated the parameter concentrations in the water were well within state standards for waters that would be acceptable for drinking water, cold water game fish and agriculture uses.

Ouray Park Canal - Data collected on Ouray Park Canal indicated that the water quality was within state standards and pollution indicators for all parameters except total phosphorus. The concentration of total phosphorus progressively increased down the canal. Above Pelican Lake, the concentration exceeded the state indicator value of 0.05 mg/l in 11 out of 18 samples collected. The mean concentration was 0.085 mg/l. This indicated that the canal was a significant source of total phosphorus entering Pelican Lake. Pelican Lake is currently a Clean Lakes project. It is listed on the 303(d) list of

water bodies as having total phosphorus, dissolved oxygen and pH problems.

Brough Reservoir Spillway - Data were collected because of the desire to learn what effects any spillway flow might have on downstream Pelican Lake. Only four samples were collected at this site, but data indicated that the water was within the standards for the parameters for Class 3A and Class 4 waters.

Ouray School Canal and Dry Gulch Canal - Only field parameters, including pH, temperature, dissolved oxygen and conductivity, were measured at the stations on these canals. Relatively high conductivity readings were observed at the Ouray School Canal. The station on Dry Gulch Canal did not have conductivity readings as high.

Strawberry River Area

The Strawberry River from Starvation Reservoir to the Avintaquin Canyon Creek confluence was assessed as having elevated levels of phosphorus. Portions of Currant Creek, Red Creek and all of Avintaquin Creek also had elevated levels of total phosphorus. These stream segments need further evaluation to determine if there is an impact to the fisheries. Indian Canyon Creek was assessed as not supporting its agriculture uses because of high levels of total dissolved solids (salinity). It also had high levels of phosphorus.

Lower Green River/Desolation Canyon Area

Waters of the main stem Green River were assessed as fully supporting their use class. Each of the small streams listed below flow directly into the Green River. Pariette Draw was only assessed for agricultural use because insufficient data were collected to assess it for its other classifications. Eleven of 13 samples exceeded the state standard for total dissolved solids, and it was assessed as not supporting its classifications. The sources of the problem were irrigation return flows, grazing and habitat modification.

Nine Mile Creek was assessed as not supporting its aquatic life classification, because of high water temperatures. Habitat modification and irrigation were factors causing the high temperatures in the stream.

The lower segment of Range Creek was assessed as fully supporting its beneficial uses. The middle and upper reaches were not assessed.

Rock Creek, a tributary to the Green River, was not assessed because it was classified as an intermittent stream.

Willow Creek Area

This stream also flows directly into the Green River. Excessive levels of total dissolved solids were the reason for listing Willow Creek from Green River to the Meadow Creek confluence as partially supporting its agriculture beneficial use.

A major concern is the pollution occurring at sites associated with water-based recreation. Flaming Gorge and Strawberry reservoirs are primary examples. Activities that pollute the drinking water at these sites include vehicles parked on the beaches, boats that leak oil, dogs, inadequate sanitary facilities, two-cycle watercraft motors, and cattle and wildlife grazing in nearby watersheds.

Table 12-5 lists the point sources in the Uintah Basin watershed having discharge permits and monitored by the Division of Water Quality.

12.4.2 Groundwater

High stream flows in the spring often leads to overirrigation, which may result in deep percolation far beyond leaching requirements. Drainage flows intermingle with salt-bearing formations such as Mancos Shale, increasing salt pickups beyond what would occur naturally. Seepage from canals and laterals, especially where the canal passes areas of high infiltration, can increase salt pickups in Mancos Shale areas.

Most groundwater pollution is from natural geologic sources such as the Green River and Wasatch formations. Excesses of selenium and alkali have been monitored in Stewart Lake. The state standard of five micrograms per liter established for wildlife protection has been exceeded in the drain water to Stewart Lake. Studies completed at Stewart Lake Waterfowl Management Area, Lower Ashley Creek, Ouray National Wildlife Refuge and Pariette Wetlands

Table 12-5
Potential Point Sources

Source
Manila Lagoons
USBR-Flaming Gorge WWTP
USFW-Jones Hole FH
USBR Upper Stillwater Dam 001
Whiterocks FH
Ashley Valley WTP
Ashley Valley 001 Effluent
Ashley Valley 002 (Winter Storage Pond) DIS
Neola Lagoons
Intermountain Concrete Company Outfall
Intermountain Concrete Company Pumped Discharge
Equity Oil 001 Formally 002
Equity Oil Company Combined Effluent AB CNFL Equity Oil Effluent No. 001 Discontinued
McKenzie Petroleum Company (002)
McKenzie Petroleum Company (001)
Hollingsworth and Travis Company Effluent
V & W Oil (Precision)
DenverAmerica-BHP Fort Duchesne Lagoons
Penzoil Products Co. Effluent Roosevelt Lagoons
Duchesne Lagoons
American Gilsonite 017 (W of 007)
American Gilsonite 007
Ziegler Chemical 003 ½ Mile W/SW of Office
Ziegler Chemical 004 100 Yards N of Office
Ziegler Chemical 001+002 1/4 Mile S/SE of Office
American Gilsonite Discharge 006
American Gilsonite Discharge 021/004 1/4
American Gilsonite #18 WNW of Hdqtrs Bonanza WWTP
American Gilsonite Discharge 008
American Gilsonite Discharge 009
American Gilsonite 019 (E of 020)
American Gilsonite 020 (E of 016)
American Gilsonite Discharge 010
American Gilsonite 016 (N of Ziegler & E)
Lexco Inc.
Penzoil Products Co., Roosevelt

Source: Utah Department of Environmental Quality, Division of Water Quality, 1997.

identified several areas where selenium[85] was adversely affecting water quality and creating a hazard to wildlife. The source of contamination at Stewart Lake[86] is drain water and shallow groundwater from soils derived from Mancos Shale. Median selenium concentrations in all drain water discharged to Stewart Lake exceeded the state standard established for wildlife protection of five micrograms per liter. Selenium concentrations in biological tissues sampled at Stewart Lake Waterfowl Management Area were high compared to concentrations in the biota from most other sites in the middle Green River Basin.

Selenium concentrations in Ashley Creek[84] upstream of the city of Vernal generally were less than one microgram per liter, but 12 miles' downstream concentrations averaged 73 micrograms per liter. The source of the contamination is believed to be from inflows of shallow groundwater as well as sewage lagoon system seepage that flows through Mancos Shale and mobilizes selenium. Waterfowl from the area contained selenium concentrations as high as 27.2 micrograms per gram in muscle tissue and an eared grebe egg contained 71 micrograms per gram.

Selenium contamination of ponds at Ouray National Wildlife Refuge was limited to a small area on the western part of the refuge, due to seepage of shallow groundwater into waterfowl ponds. Geometric mean concentrations in plants, invertebrates, bird eggs and fish from the North and South Roadside Ponds were larger than concentrations known to cause reproductive failure in mallards (*Anas platyrhyncos*). Mallards exposed during a field experiment at the Roadside Ponds quickly accumulated selenium in body tissues and died by the fourth week.

Water-quality deterioration in Pariette Wetlands was believed to be due to the discharge of tail water and accrual of groundwater into the area. Selenium concentrations in the biota from Pariette Wetlands ranged from fairly low, near background levels to highly elevated levels associated with known adverse effects in the literature.

12.5 Alternative Solutions

The Colorado River Salinity Control Program was developed to reduce the salt load carried to the Colorado River System by improving irrigation efficiency and reducing deep

percolation. The Uinta Basin Unit is a part of that program.

In agriculture, irrigators flush the salts from the soil to maintain good crop production. They do this by using extra irrigation water which percolates downward through the soil and then laterally to waterways. This process, known as leaching, eventually flushes salts into rivers and streams that empty into the Colorado River. Nearly half of the salts come from natural sources, such as precipitation runoff, while about a third comes from agriculture. The balance comes from point sources.

The *NRCS Uinta Basin Unit Selected Plan* (which includes the Duchesne and Ashley/Brush Valley drainages) projects a reduction of 52,400 acre-feet of return flow from on-farm irrigation, deep percolation and off-farm lateral seepage loss. It also projects a total of 106,800 tons of salt-load reduction to the Colorado River.

To accomplish these objectives, 64 percent of the potentially treatable irrigation farmland (137,000 acres) will be treated with on-farm improvements. The total irrigated area covers 201,120 acres. On-farm improvements, coupled with improved irrigation water management, reduce the salt-load contribution of this acreage. This program will also contribute to economic development by increasing agricultural production in an otherwise depressed area. An effort will be made to minimize wildlife habitat losses resulting from the program and, where possible, habitats will be developed, improved or preserved.

Mitigation for loss of wetlands and upland habitats consists of land owners setting aside areas exclusively managed for the propagation of wildlife species. These areas must show an increase in wildlife values. Wetland management includes nesting islands, plants, fencing, grazing management, water control and burning control. Upland management includes grazing management, plants, irrigation for wildlife food plots, windrows, and fencing controls for grazing during nesting periods.

Total monitoring and evaluation costs to date for 2,490 acres of wildlife wetland habitat and 12,750 acres of upland wildlife habitat have been $478,170 (1996 Monitoring and Evaluation Report).

The objectives of the Colorado River Salinity Control Program are to provide financial and technical assistance to:

- Increase the average irrigation efficiencies throughout the Uintah Basin to 51 percent.
- Improve irrigation efficiencies on 137,000 acres of farmland.
- Install conservation practices to reduce salinity levels in the Colorado River by 106,800 tons of salt annually.
- Develop, improve and preserve wildlife habitats.
- Carry out research, education and demonstration activities.
- Carry out monitoring and evaluation activities.

12.5.1 On-Farm Activities

Prior to implementation of the selected plan, a total of 35,100 acres received treatment through improved irrigation systems. An estimated 10,200 acres were improved with sprinkler systems, while 24,900 acres were treated with improved surface systems. Portions of the improvements were installed with assistance through the USDA Agricultural Conservation Program (ACP) cost-share program.

As of 1996, a total of $65,634,138 has been obligated for salinity funding. This amount of money covered 2,384 long-term agreements and annual contracts.

12.5.2 Off-Farm Activities

The Bureau of Reclamation has completed one study (Phase I) and initiated a second phase study of the major canals and laterals. These studies identify the highest areas of seepage loss. The Phase I plan proposes to line 55.5 miles of canals and laterals to control high seepage loss. This equals 39 percent of the total miles evaluated

during the Phase I study. Implementation of Phase I has been postponed indefinitely. Phase II was initiated in 1986. The Bureau's preliminary findings for Phase II have been reported. The report recommends that planning investigation be terminated on Phase II. However, it also recommends that 3.2 miles of canal lining, and investigation of the use of canals to carry winter livestock water, be included in Phase I preconstruction activities. The Natural Resources Conservation Service will assist the Bureau of Reclamation in developing and coordinating treatment alternatives.

The U. S. Department of Agriculture (USDA) has completed improvements on some laterals in conjunction with planned on-farm irrigation system improvements. These lateral improvements are the result of farmer groups collectively piping water for the purpose of obtaining pressure to operate sprinkler systems and for water conservation. Farmers grouping together for this purpose will be a continuing occurrence in the project area. During nine years of CRSC funding, approximately 865,105 feet of off-farm pipeline have been installed.
The Duchesne County Commission, in cooperation with the Duchesne County Water Conservancy District, is responsible for a new canal project. The project will include extensive improvements to the Payne Canal, the Sand Wash Irrigation Company Project, a Dry Gulch irrigation canal, a canal in Fruitland and a canal in the Lower Pleasant Valley area. It will take approximately four years to complete the canal rehabilitation project.

12.5.3 Indian Lands

Approximately 70,000 acres of land in the Ute Tribe Reservation could be irrigated. Only 31,720 acres of Indian-owned lands and 29,280 acres of non-Indian lands are serviced with Indian water. These lands are interspersed throughout the Uintah Basin with other private and federal lands. The checkerboard pattern of land ownership makes it imperative that cooperation is obtained by all owners. About 749,900 acres of homestead lands are within the Uintah and Ouray Indian Reservation.

Responsibility for water quality issues on Indian lands has been delegated by the EPA to the Ute Tribe. The tribe may set its own standards in preparing and implementing water quality plans. About 3,000 acres of Indian lands have been operated by non-Indians treated under the Agricultural Conservation Program (ACP) using the annual practices. This is because long-term agreements are not allowed under tribal leasing arrangements.

The regulations in the CRSC program state that the USDA can cost-share with Indian tribes. Unfortunately, this provides the opportunity for the Ute Indian Tribe to only participate as a single entity with a cost-share payment approval limitation of $100,000. This restricts the program opportunities.

Indian lands are administered by allotments, assignments, trust lands and private lands. Each has different rules and regulations. The Bureau of Indian Affairs has responsibility to oversee all these lands, whereas the Tribal Business Council has responsibility to provide leadership on assigned and trust lands. Under the restraints of different type ownerships, 25-year leases become extremely difficult. The allotted lands may have multiple assignments on the same parcel of land.

Due to the many institutional restraints imposed upon the Indian lands, successes in improving Indian lands and participation of the Ute Tribe or individual Indians in the USDA program have been rare.

Many meetings have been held with the Bureau of Indian Affairs and Ute Tribe officials to identify problems and overcome them. It was agreed a project with Indian lands as well as private lands should be identified. The Whiterocks Irrigation Project has been selected. The project covers 42.6 miles of canal, will prevent 2,220 tons of salt load each year in waterways, and covers approximately 4,020 acres that will save an additional 65,040 tons of salt load per year. The estimated cost for this project will be approximately $5 million. A second project is the Randlett Tribal Farm which consists of 1,100 acres of tribal land. The estimated cost of this project is approximately $750,000.

Agricultural practices can be changed to minimize the animal waste entering streams. Stream bank erosion can also be prevented. Information and education programs can be developed to teach urban citizens about reducing urban pollution runoff to waterways. Cities and counties can be zoned to protect water quality and raise awareness of land developers about how construction activities can impact water quality.

12.6 Issues and Recommendations

Water quality issues are primarily associated with agriculture and oil and gas drilling. While the agricultural sector has reduced non-point source pollution such as phosphorus and TDS, urbanization has led to increasing pollution from point sources.

12.6.1 Colorado River Salinity Impact

Issue - Runoff from irrigated agriculture in the Uintah Basin increases salt-loading to the Colorado River.

Discussion - Abundant irrigation water in the spring season leads to excess irrigation and deep percolation. Drainage flows seep into salt-bearing materials, increasing salt pickup. This salt-laden water flows to the Green River then to the Colorado River, increasing the salinity downstream.

Adequate leaching takes only about 10 percent more irrigation water than the crop requires. The emphasis is to reduce salt pickup by reducing deep percolation from irrigation. This can be achieved with improved irrigation methods along with modifying or replacing the irrigation system. For example:

- Irrigation efficiencies should be improved either by conversion to sprinkler systems or by improving surface irrigation methods.

- Where the land contour inherently promotes flood or border irrigation inefficiencies, sprinkler systems could reduce runoff and provide more uniform water application.

- Irrigation scheduling and water management education programs should be expanded.

- Seepage from canals and laterals can be reduced by lining them with clay soils, plastic or asphalt membranes, slip-formed concrete, or piping with plastic, steel or concrete pipe.

Recommendation - The federal government should increase funding to the on-farm (USDA) and off-farm Bureau of Reclamation salinity programs to achieve goals in salinity reduction.

12.6.2 Oil/Gas Well Drilling and Production

Issue - Water and land contamination due to oil/gas well drilling and production needs to be reduced.

Discussion - Potential impacts to surface hydrology may be the result of construction and maintenance of access roads, well pads and pipelines as well as pits, use of water for drilling and disposal of waste water. Impacts to water quality include increased sedimentation, human waste pollution-loading, chemical pollution-loading, and oil and/or gas discharges. These effluents must comply with permit requirements of the Federal Water Pollution Control Acts, National Pollution Discharge Elimination System (NPDES) and the standards of water quality for the state of Utah code, as annotated. Wetland protection must comply with Section 404 of the Clean Water Act, 1972.

Recommendation - The Bureau of Land Management, Forest Service and the Utah Division of Water Quality should increase monitoring the water quality in selected drainages for any presence of effluent from oil and gas development projects.

12.6.3 Elevated Levels of Phosphorus and Total

Dissolved Solids Issue - Elevated levels of total phosphorus and total dissolved solids in several basin streams indicate possible impairment to these waters.

Discussion - Phosphorus and total dissolved solids in streams are viewed as indicator

pollutants in the *Standards of Quality for Waters of the State, R 317-2, Utah Administrative Code*, but are not regulated substances themselves. They indicate that further work with dissolved oxygen, sediment, riparian condition, stream habitat, limnology and macro invertebrate ecology is necessary to establish if the waters are meeting their beneficial use class.

Recommendation - The Utah Division of Water Quality, Division of Wildlife Resources, U. S. Fish and Wildlife Services, Bureau of Land Management, Forest Service and others should cooperate in future data-gathering and analysis. ❑

Content

Section 13
Uintah Basin Plan

Utah State Water Plan

Disaster and Emergency Response

Government, communities and families all have a part to play in responding to emergencies. Being prepared may prevent an emergency from becoming a disaster.

13.1 Introduction

This section discusses flood hazard mitigation and drought response. It also briefly discusses programs presently in place and additional programs that could be beneficial in dealing with flooding and drought problems. The Division of Comprehensive Emergency Management (CEM) is the designated state coordinating agency for disaster and emergency response. Many types of emergency situations are water-related, varying from disastrous flooding to extreme drought. When a state emergency arises, a response plan, maintained by the Utah Division of Comprehensive Emergency Management (CEM), provides quick and effective coordination of state resources. The state also maintains a State Hazard Mitigation Team (SHMT) to provide hazard mitigation planning assistance to local jurisdictions and counties. The SHMT efforts may focus on either pre-hazard mitigation planning or post-hazard mitigation planning. Both planning efforts focus on measures that may lessen or eliminate the impact of future disasters. The following paragraphs define the organizational responsibilities for emergency response in the Uintah Basin, concentrating mainly on the two most common water-related emergencies, floods and droughts.

13.2 Background

Federal, state and local governments have statutory authority to plan for and respond to disasters. No one entity has enough authority to make and carry out all decisions necessary to mitigate a specific hazard or respond to a disaster. Sections 13 and 16 of the *Utah State Water Plan* (1990) present the specific authorities and programs vested in the various agencies.

13.3 Organizations and Regulations

Local, state and federal agencies are encouraged to work together in preparing for, and mitigating damages from, disaster events. Each level of government can contribute ideas and resources from their unique perspective.

13.3.1 Local

Local agencies are responsible for initial responses to emergencies. Cities and counties have primary responsibility for disaster response. This is articulated in Titles 10 and 17 of the *Utah Code Annotated, 1953, amended*. The agencies responsible for disaster response in Uintah and Duchesne counties are the county commissions. In Wasatch and Summit counties, the responsible agencies are Wasatch County Emergency Services and Summit County Emergency Services, respectively. In Daggett County, the mayor of Manila has the responsibility.

Local governments are required to carry out the following tasks to provide an effective first response to emergencies:

- Prepare an emergency operations plan for the coordination of local and county emergency responses and link it to potential assistance from appropriate federal and state agencies.
- Provide necessary resources (including special supplies and equipment) to support emergency relief operations and list these resources.

Procedures to be followed for obtaining assistance and use of resources in the emergency operation plans should be included.

- Assign and train personnel needed to perform disaster relief functions.

- Provide the State Disaster Coordinating Officer with copies of current emergency operations plans.

The Three County Local Emergency Planning Committee has a project called the *Green River Sub-Area Contingency Plan*, which deals with national oil and hazardous substances pollution.

13.3.2 State

In the event property damage and personal injuries exceed the capability of local agencies, the Governor may declare a "state of emergency." A state of emergency provides state assistance and allows the state to request federal assistance.

When a state of emergency is declared, the Governor's State Disaster Coordinating Office (SDCO) assumes responsibility for distributing state and federal assistance to local disaster victims. The SDCO works with local coordinators to distribute aid in an efficient and effective way. The SDCO also serves as the governor's primary point of contact for all disaster-related correspondence between federal, state and local disaster management officials.

One responsibility of the Utah Division of Comprehensive Emergency Management (CEM) is to generate an interest in developing emergency response and management plans. The CEM will assist towns, cities and counties prepare their own comprehensive emergency response and management plans. These plans should allow for close cooperation with state and federal agencies in the event that major disaster goes beyond local capabilities.

13.3.3 Federal

Federal assistance in a local disaster begins with a request from the Governor. If the President of the United States declares the event a federal emergency or major disaster, the state is eligible for federal assistance. Many assistance programs are available through the Federal Emergency Management Agency (FEMA). A "federal emergency" declaration makes available federal funding that may be required to save lives, protect property and restore essential public services. A "major disaster" declaration allows funding to restore public and private property and to change natural or man-made conditions that may contribute to future damage or additional disasters.

The Corps of Engineers frequently becomes involved in relief of flooding problems, at the request of the CEM, in the form of technical assistance, prevention, flood-fight assistance and post-flood mitigation recommendations. Emergency assistance is also provided by the U. S. Natural Resources Conservation Service and Farm Service Agency in times of drought, earthquakes or other natural disasters.

13.4 Flooding Problems

Damages from the major snowmelt flood in 1983 totaled about $10.1 million in the Uintah Basin. During the 1997 spring runoff, the Mosby Canal overtopped, causing extensive damage to the mountainside, stream system, and water conveyance and treatment systems. The estimated damages totaled about $6.4 million. Table 13-1 shows historical damages from flooding on major basin streams.

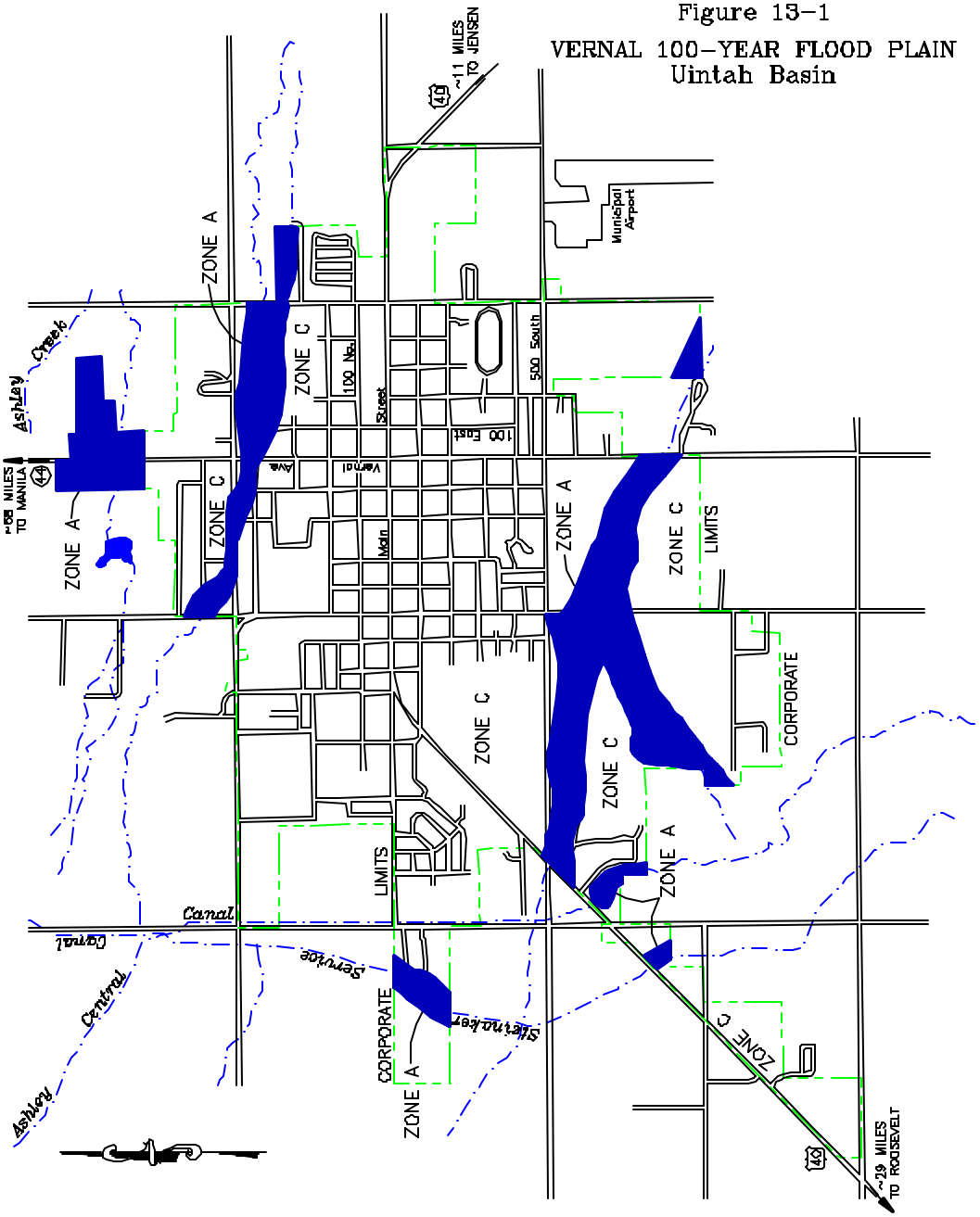
Flood Insurance Rate Maps in Figures 13-1, 13-2 and 13-3 are shown for Vernal, Myton and Duchesne cities. These maps are provided by FEMA.

13.5 Other Water-Related Emergency Problems

Water-related emergencies may arise from different types of events. Included are droughts, earthquakes, land slides and toxic spills.

Figure 13-1

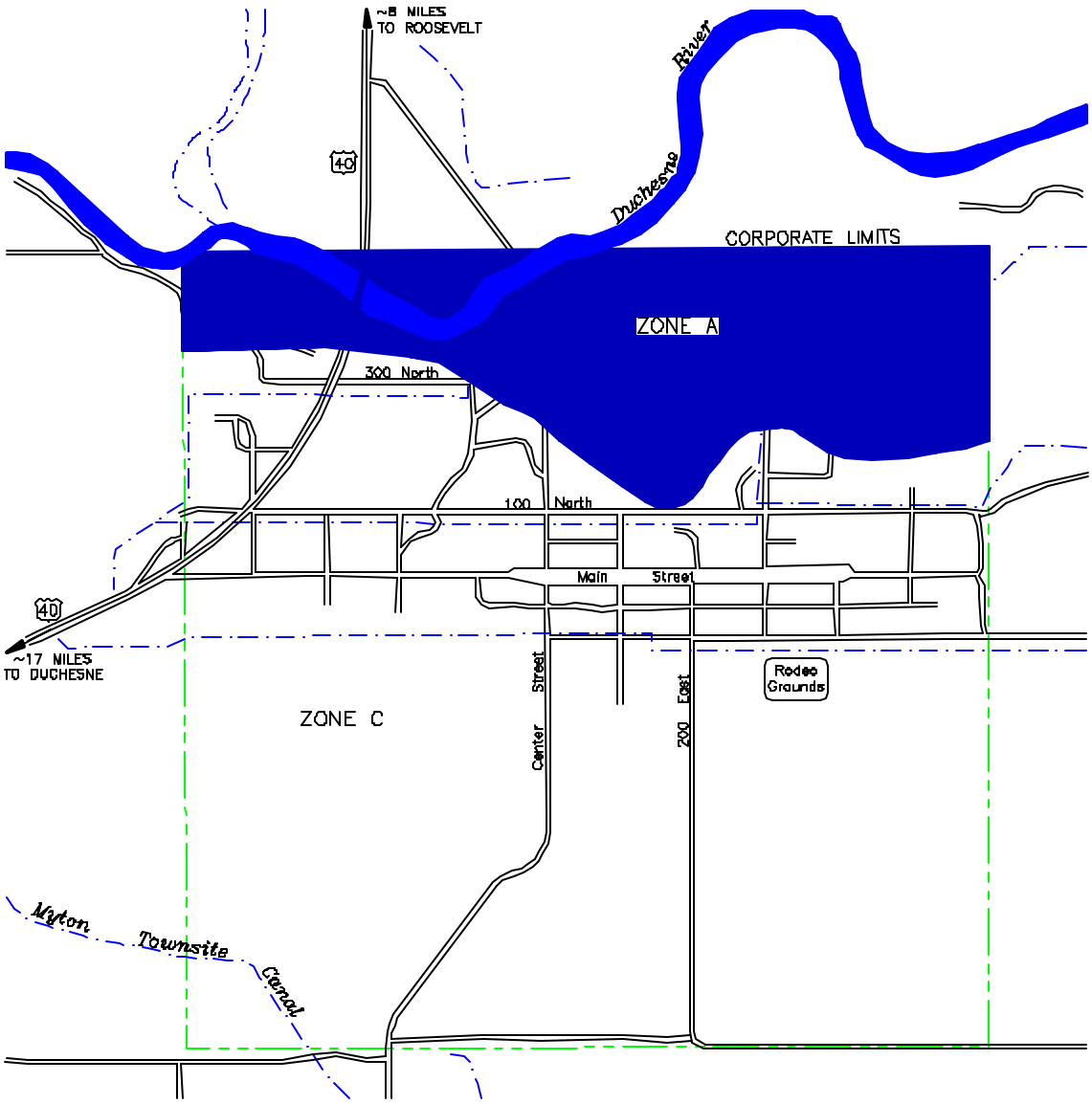
VERNAL 100-YEAR FLOOD PLAIN
Uintah Basin



Legend

	100-Year Flood Plain Area
Zone A	Flood Depths 1-3 Feet and Velocities Determined.
Zone B	Flood Depths Less Than 1 Foot and Velocities Determined.
Zone C	Areas of Minimal Flooding (No Shading)
RM 2	Reference Monument

Source: Federal Emergency Management Agency (FEMA)



Legend

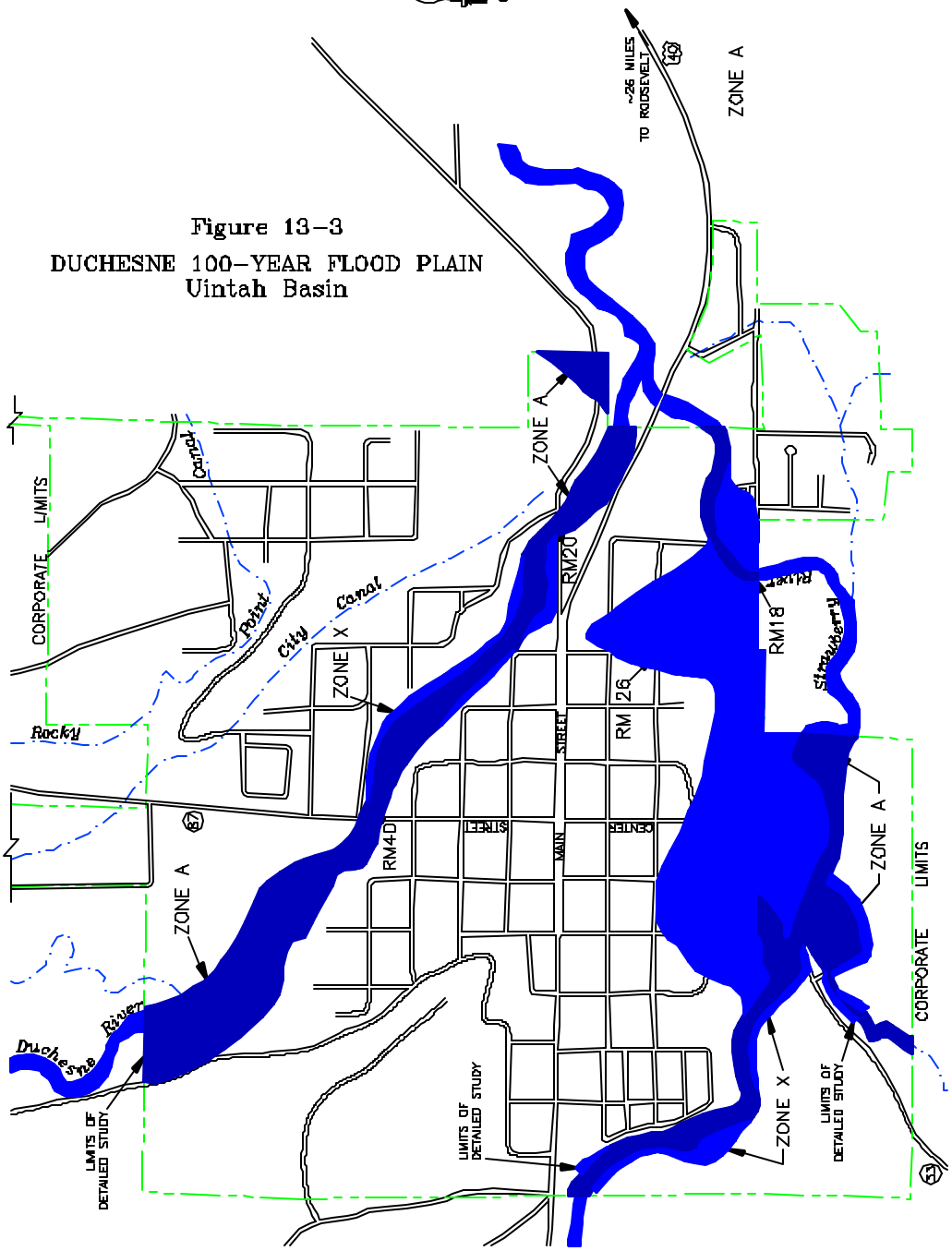
	100-Year Flood Plain Area
Zone A	Flood Depths 1-3 Feet and Velocities Determined.
Zone B	Flood Depths Less Than 1 Foot and Velocities Determined.
Zone C	Areas of Minimal Flooding (No Shading)
RM 2	Reference Monument

Source: Federal Emergency Management Agency (FEMA)

Figure 13-2
MYTON 100-YEAR FLOOD PLAIN
Uintah Basin

Figure 13-3

DUCHESNE 100-YEAR FLOOD PLAIN
Uintah Basin



Legend

	100-Year Flood Plain Area	Zone X	Areas of 500-year Flood
	500-Year Flood Plain Area	Zone B	Flood Depths Less Than 1 Foot and Velocities Determined.
Zone A	Flood Depths 1-3 Feet and Velocities Determined.	Zone C	Areas of Minimal Flooding (No Shading)
		RM 2	Reference Monument

Source: Federal Emergency Management Agency (FEMA)

Table 13-1 Flood Damages			
Stream	Location	Date	Damages ($ million)
Sheep Creek	Daggett	1965	8.0
Ashley Creek	Vernal	1983-84	3.7
Duchesne River	Duchesne	1983-84	6.4
Dry Fork/Ashley Creek	Vernal	1997	6.4

13.5.1 Drought

The Uintah Basin experienced extended droughts, starting in the 1930s. Effects of future drought events have been minimized by significant water storage that is available in Strawberry, Starvation, Currant Creek, Upper Stillwater, Steinaker, Red Fleet, Moon Lake and Big Sand Wash reservoirs.

13.5.2 Earthquakes

An earthquake is one of the more threatening natural disasters that may occur in the Uintah Basin. This could create losses of lifeline and transportation services and could damage the structural integrity of major dams. Culinary water systems as well as irrigation systems could also be damaged. Ground-shaking also has the potential to change the quantity and quality of water from wells and springs.

The Bureau of Reclamation is currently reevaluating all federally constructed dams to assess structural integrity against various levels of seismic intensity. Steinaker Dam was upgraded in 1995 to insure structural integrity during seismic activity. The Utah Division of Water Rights (Dam Safety Section) is in the process of evaluating all high and moderate hazard non-federal dams in the state. This evaluation includes seismic stability.

13.5.3 Landslides

The Mosby Canal overtopped in 1997, due to a deep snowpack and rapid snowmelt. This caused extensive damage to the mountainside and stream system. Millions of tons of red sediment, containing sand, clay, boulders, trees and general debris, were washed into Ashley Creek. The sediment caused damage to the irrigation canals and agricultural, municipal and industrial water systems.

13.5.4 Toxic Spills

The potential exists for spills of toxic substances into the Strawberry, Duchesne and Green rivers, as well as Ashley Creek, especially near the numerous oil wells in the basin. Crude oil is piped or transported by tank trucks from the oil wells to storage tanks where it is stored for further transportation to Salt Lake City for refinement. There is also a problem with oil spills at the oil well sites. Since the receiving waterways present potential sources of municipal water, disastrous damage is possible. Soil contamination and underground aquifer pollution is also possible at these sites. Also, some water is pumped with the oil to the surface. This water is separated from the oil and re-injected into back-flooding wells.

13.6 Flood Damage Prevention Alternatives

Preparation through planning and ongoing activities helps to minimize future damages. Government agencies, private organizations and families have important roles in flood damage prevention.

13.6.1 Flood Plain Zoning and Insurance

The National Flood Insurance Program (NFIP) was established by Congress with the passage of the National Flood Insurance Act of 1968. The NFIP is a federal program enabling property owners to

purchase insurance protection against losses from flooding and to discourage unwise development in flood plains. Insurance is designed to provide an alternative to disaster assistance and underwrite the escalating costs of repairing damage to buildings and their contents caused by floods.

Participation in the NFIP is voluntary and based on an agreement between local communities and the federal government. The agreement states that if a community will implement and enforce measures to reduce future flood risk to new construction in special flood hazard areas, the federal government will make flood insurance available within the community through private insurers as a financial protection against flood losses that do occur.

Flood insurance will not be available in communities having designated special flood hazard areas that choose not to participate or have been sanctioned by FEMA. Sanctioned communities are communities that have an identified special flood hazard area and have either failed to adopt or failed to enforce the required flood plain management ordinances. No disaster assistance will be available for repair or replacement of real or personal property in special flood hazard areas within nonparticipating or sanctioned communities. Communities currently participating in the NFIP in the basin are shown in Table 13-2.

Uintah, Duchesne and Daggett counties participate in the NFIP. Three separate participating communities are Duchesne, Myton and Vernal. The basin has approximately 25 policies in force and a total dollar coverage of approximately $2,295,000. These communities agree to enact and enforce minimum flood plain management requirements as stated in the *Code of Federal Regulations* (44 CFR), Part 60.3. These regulations apply to new construction and substantial improvements.

The Division of Comprehensive Emergency Management is the state coordinating agency for the NFIP. This office can help local participating communities achieve flood plain management objectives defined by the NFIP. Also, the U. S. Army Corps of Engineers, through its Flood plain Management Services Program, can develop or upgrade flood plain boundary maps at no cost for communities in need. Requests are made through the state flood plain administrator. Zoning and flood hazard reduction regulations have been adopted by local jurisdictions and counties to shape future construction to minimize damage in flood events.

Dry Fork Washout

13.6.2 Watershed Protection

Five watershed projects are being considered. See Section 10 (Sub-section 10.5.3) for more information.

13.6.3 Flood Control Structures

Prevention of flood damage depends much on families, cities and counties being prepared for a flood event. Local ordinances governing subdivision development and transportation planning should provide for safe disposal of all surface flows. Managing the stream channel where surface flows accumulate is also important. Table 13-3 shows CEM actions that should be considered by local and state agencies to prevent flood damages along major basin streams.

13.7 Drought Damage Reduction Alternatives

Drought damage can be reduced by precipitation augmentation, water conservation, increasing carryover storage in reservoirs during non-drought years and drought planning.

Table 13-2
National Flood Insurance Program Participants

Community Name	County	Date of Entry	Date of Current Map
Duchesne	Duchesne	2/4/88	2/4/88
Myton	Duchesne	2/4/88	2/4/88
Uintah County	Uintah[a]	2/1/86	2/1/86
Vernal	Uintah	3/18/86	3/18/86

[a]Incorporated areas only.

Table 13-3
Flood Damage Prevention Measures

Stream	Location	Action
Duchesne River	Duchesne	Streambanks Protection
Ashley Creek	Vernal	Streambanks Protection Bridge Abutment Protection Sediment Removal Upstream of Steinaker Feeder Canal Diversion Build Upstream Storage Reservoir
Brush Creek	Vernal	Follow Prescribed BR Flood Flow Releases for Red Fleet Reservoir
Duchesne	Duchesne	Follow Prescribed BR Flood Releases for Starvation Reservoir
Red Creek	Nr Dutch John	Debris Basin
Dry Fork	Nr Maeser	Bank Stabilization
Yellowstone River	Nr Altonah	Build Storage Reservoir
Uinta River	Nr Neola	Build Storage Reservoir
Whiterocks River	Nr Whiterocks	Build Storage Reservoir
White River	Nr Bonanza	Build Storage Reservoir
Red Creek Reservoir	Nr Fruitland	Fix Leak/West Abutment

Drought planning is a useful process to help people responsible for providing water supplies think ahead to the next drought and prepare long-range plans. Utah's drought response plan is available to provide guidance.[151]

Of immediate concern to water managers who engage in drought planning are tourism, wildlife and agricultural enterprises and cities. Hydroelectric power generation and water quality can also be adversely affected. As cities grow and tourism

activities expand, wildlife and agriculture become more vulnerable. Drought plans can establish priorities of water use.

Local governments and water right owners should develop understandings and contracts so water is more readily available when droughts occur. These can provide for water sharing so that the most valued activities continue and those who give up water temporarily are compensated. Each county in the basin should prepare, and occasionally update, a drought response plan

13.8 Other Emergency Alternatives

Actions that ensure basic security in the face of nearly all disasters include:

- Disaster response plans by individual communities and counties.
- Investigation and construction of water storage and flood damage prevention projects.
- Family emergency response plans and 72-hour emergency kits.

The Division of Comprehensive Emergency Management suggests all residents prepare a 72-hour emergency survival kit. According to experts in the field, this will allow adequate time for relief efforts to reach most residents. Along with preparing this kit, families should develop their own emergency plan outlining each member's responsibility during a disaster.

Emergency preparedness drills are a good way to familiarize family members with their duties and help ensure the family's safety. Knowing when and how to turn off natural gas, water and electric power utilities can reduce damage and save lives. Utility companies and water providers should publish guidelines.

Flood damage may be reduced by structural as well as nonstructural methods. Establishment of a storm drainage utility is an example. Plans should provide adequate flood plain management objectives to reduce flood losses. Hazard mitigation plans can be carried out by communities to deal with specific identified potential disasters such as flooding and alluvial fan development.

13.9 Issues and Recommendations

Three policy issues are discussed. They are flood plain management, hazard mitigation planning and disaster response plans.

13.9.1 Flood Plain Management

Issue - Not all local governments have plans for managing flood plains to prevent flood damage, and some plans need to be updated.

Discussion - Record precipitation in late 1982 and early 1983 created record flooding in this basin. Ashley Creek peaked at 3,800-4,200 cfs, about two to three feet above flood stage. Both costly and disruptive, this flooding exposed the vulnerabilities in local flood protection planning. Since then, stretches of Ashley Creek and the Duchesne River have been dredged. Storm drainage systems have been expanded, and awareness of flooding potential has been heightened. Flood damage prevention studies have been prepared for proposed improvements to decide feasibility and effectiveness. Where undeveloped flood plains exist, periodic flooding of wetlands and riparian areas can serve to perpetuate a critical habitat for a variety of wildlife species.

Recommendation - Participating NFIP communities should actively review their local flood damage prevention ordinances to insure they are meeting the minimum requirements for participation in the National Flood Insurance Program. An educational program on the importance of flood plain value, purpose and appropriate management should be instigated.

13.9.2 Hazard Mitigation Plans

Issue - Not all communities have hazard mitigation plans.

Discussion - Community leaders are encouraged to develop mitigation strategies to eliminate or lessen impacts of a disaster. In the hazard mitigation planning process, agencies set priorities for these strategies and estimate costs and time frames to address proposed mitigation. Hazard mitigation may include structural and nonstructural

activities as they relate to flood protection. The Division of Comprehensive Emergency Management is responsible for disaster and emergency response at the state level. It prepares, carries out and maintains state mitigation programs.

Recommendation - Local governments should prepare hazard mitigation plans with assistance from the Division of Comprehensive Emergency Management.

13.9.3 Disaster Response Plans

Issue - All communities do not have a disaster response plan.

Discussion - Local governments need to increase their ability to respond to natural disasters and emergencies. Emergency Operations Plans (EOPs), also called Disaster Response Plans, address disaster response and recovery activities following a disaster. These plans should be prepared ahead of time allowing counties, cities and towns to coordinate efforts and define responsibilities. Elected officials and agency managers should decide leadership positions and timing of response activities. Uintah, Duchesne and Daggett counties have Emergency Operation Plans (EOPs) that identify hazards in the counties. An EOP can also address disruption or contamination of, or an exceptional shortfall in, water supply emergencies and may result in a temporary limitation of available water. When this happens, water managers should set priorities on deliveries to meet critical needs first. Emergency Actions Plans (EAPs) have also been developed, or are being developed, for all dams in the state. The Division of Comprehensive Emergency Management reviews the private dam EAPs to ensure an adequate list is incorporated in the plan. This review is done in cooperation with the State Engineer's Dam Safety Section.

The Division of Comprehensive Emergency Management has the statewide responsibility of planning for, responding to, recovering from and mitigating emergencies. It has developed statewide plans for disaster response.

Recommendation - Local communities should develop emergency operation plans with the assistance of the Utah Division of Comprehensive Emergency Management. ❑

Content

Section 14
Uintah Basin Plan

Utah State Water Plan

Fisheries and Water-Related Wildlife

Wildlife habitats vary from the alpine environments of the High Uintas to the desert setting of southern Uintah and Duchesne counties. These habitats support an equally diverse population of fish and wildlife species whose needs must be considered with those of humans who share the resources.

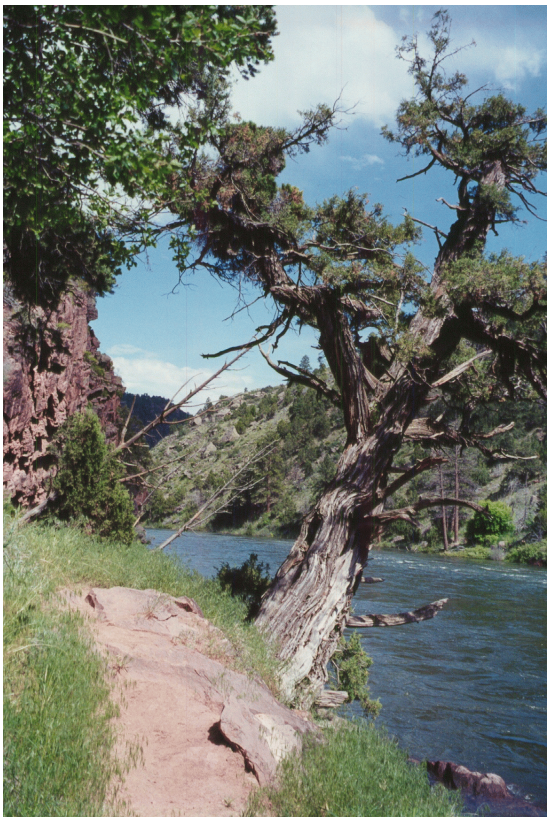
14.1 Introduction

This section describes the fisheries and other water-related wildlife currently found in the basin. It also identifies associated problems and presents alternatives to improve these resources. The Division of Wildlife Resources has responsibility for managing, protecting, propagating and conserving the state's wildlife. Some federal agencies have limited authority for wildlife management on lands they administer. The Fish and Wildlife Service has authority to conserve and protect endangered and threatened species on federal and private lands.

14.2 Setting

This basin has unique ecosystems supporting a diversity of species. The focal point for most of the wildlife habitat is the Duchesne and Green River drainages. Stewart Lake State Waterfowl Management Area and Ouray National Waterfowl Refuge are nearby. Fish hatcheries are located at Ouray National Waterfowl Refuge, Jones Hole and near Whiterocks.

The primary waterway is the Green River with the Duchesne River, Ashley Creek, Brush Creek, Sheep Creek, Henrys Fork and White River as tributaries. Most of the major drainages support good quality riparian and fish habitats. Some are also affected by reservoirs, irrigation diversions and highways. Irrigation withdrawals reduced each stream's value as a fishery, such as Ashley Creek and the Duchesne River. The Green River below



Green River

Flaming Gorge Reservoir has some of the best trout fishing in the state. Excellent fishing also occurs in the high mountain lakes and tributaries of the Uinta Mountains.

14.2.1 Fish and Wildlife Species

An estimated 85 species of mammals, 23 species of reptiles, eight species of amphibians, 268 species of birds and 50 species of fish are found in the basin. Nearly all require constant access to water. Species of fish are categorized as warm or cold water and game or non-game.

Bird species can be categorized into three groups: upland game birds, waterfowl and non-game birds. Several naturally occurring species of hunted game animals are also found. Of special interest are those species designated as threatened and endangered. Each of these species has been judged to be in danger of extinction throughout all or a significant part of its range. Threatened and endangered species are protected by federal and state statutes. The Endangered Species Act (ESA) strictly prohibits any person from taking any federally listed member of a threatened or endangered species. Taking also means to destroy or sufficiently change the habitat of a listed species.

The ESA does not apply directly to non-federal water-related activities that do not require federal permits. Owners and operators of non-federal projects are not affected as long as the normal and ongoing operations do not result in the taking of one of these species.

The criteria for threatened and endangered status and category designations are explained in Sub-section 16.3.8 of the ESA. Fish and wildlife species classified as candidates for official listing are shown in Table 16-1 of this basin plan.

In the event federal permits are required to develop a water source or make revisions to existing ones, the Fish and Wildlife Service (FWS) will review the project. The scope and overall intent of the proposed project or change will be assessed to decide the effect on fish and wildlife in the immediate area. Endangered plants are treated differently than endangered animal species on private property. Threats to these plant species will not stop development activities in an area where federal permits are not required.

14.2.2 Fisheries

The Uintah Basin has two full-time federal fish hatcheries at Jones Hole and Ouray and a state hatchery at Whiterocks. Whiterocks Hatchery is run by the Division of Wildlife Resources. Several Class I and II fisheries for cold water, cool water and warm water fisheries can be found in the Uintah Basin. Cold water fish include most species of trout. Cool water fisheries include walleye and smallmouth bass. Warm water fish include sucker, walleye, perch, bass, crappie, blue gill, northern pike, catfish, carp and Utah chub. Endangered species such as the Colorado pikeminnow (formerly Colorado squawfish), razorback sucker, humpback chub and the bonytail chub are found in the basin. The endangered Colorado pikeminnow and humpback chub are hatched at the Ouray Hatchery for reintroduction into the Green River.

Table 14-1 lists the warm and cold water sport fish and identifies reaches of streams, rivers and reservoirs where each is found.

14.2.3 Wildlife Habitat

Habitats are the most important factor in maintaining healthy and substantial populations of fish and wildlife. Overall, habitats are influenced by the condition of the ecological system and the level and type of human activities. Water storage facilities have created habitat for nonnative species and sportfishing opportunities; however, stream habitat for native and nonnative species has been lost and degraded due to dams and reservoirs. The continued population growth and demand for water and land are in direct conflict with the needs of some species.

Title 73-3-3 of the *Utah Code Annotated* allows the Division of Wildlife Resources to file for minimum instream flow water rights for the preservation of fish species. This legislation allows the division to file requests for permanent changes in the operation of certain streams and rivers to preserve critical fish habitats and to provide permanent enhancement of the state's stream and river fisheries. Section 5 discusses instream flows and shows pre- and post-Central Utah Project requirements for this basin.

Table 14-1
Sport Fishery Streams, Reservoirs and Lakes

Species	SR	CC	St R	Star	BS	Ste	RF	FG	GR	DR	AC	BC	WR	SC	PC	ML	UR	YR	W	SRR	CLR	CRC	LFR	PL
Rainbow Trout	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Cutthrout Trout	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Brown Trout				✓	✓	✓	✓		✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	
Brook Trout		✓	✓						✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Kokanee Salmon	✓							✓							✓									
Mtn. Whitefish				✓	✓				✓	✓						✓								
Channel Catfish								✓	✓	✓	✓		✓				✓							✓
Black Bullhead										✓														✓
Splake																✓								✓
Largemouth Bass						✓	✓																	
Smallmouth Bass				✓		✓	✓	✓	✓	✓	✓						✓							✓
Bluegill						✓	✓		✓	✓							✓							✓
Black Crappie									✓	✓			✓											
Northern Pike									✓	✓			✓											
Walleye				✓					✓	✓														
Lake Trout								✓																

SR - Strawberry Res.
CC - Currant Cr. Res.
St R - Upper Stillwater Res.
Star - Starvation Res.
BS - Big Sand Wash
Ste - Steinaker Res.
RF - Red Fleet
FG - Flaming Gorge
GR - Green River
DR - Duchesne R.
AC - Ashley Creek
BC - Brush Creek
WR - White River
SC - Sheep Creek
PC - Pot Creek
ML - Moon Lake Res.
UR - Uinta River
YR - Yellowstone River
W - Whiterocks
SRR - Strawberry Res.
CCR - Currant Creek
CRC - Carter Creek
LFR - Lake Fork River
PL - Pelican Lake

14.3 Organizations and Regulations

Local, county, state and federal agencies have a part in passing and enforcing laws to regulate management of water facilities that affect wildlife. Private organizations work with these public groups to protect fish and wildlife habitats.

14.3.1 Local

State agencies, cities, counties, irrigation companies and water districts control water facilities that affect fish and wildlife. The impact may be either direct or indirect. However, early irrigation rights holders are not required to leave water in streams during time of low flow. An example is Ashley Creek at the Thornberg Diversion. The Utah Divisions of Wildlife Resources and Parks and Recreation may purchase water from these irrigators to prevent diversions and allow instream flows that protect various fishes.

Under the Central Utah Project Completion Act, the Uintah Conservation and Duchesne Conservation districts are provided incentives to conserve water for instream flows. One purpose of the Water Conservation Credit Program of the CUPCA is to "prevent or eliminate unnecessary depletion of waters in order to assist in the improvement and maintenance of water quantity, quality and streamflow conditions necessary to augment water supplies and support fish, wildlife, recreation and other public benefits."

14.3.2 State

The Division of Wildlife Resources has responsibility for the management, protection, propagation and conservation of the state's wildlife resources. Much of the project planning currently being carried out by the Central Utah Water Conservancy District must be coordinated with the mission of the division. The division has responsibility to play a lead role in identifying impacts to fish and wildlife from water development projects.

14.3.3 Federal

The federal government influences fish and wildlife management through Department of the Interior agency policies and federal legislation. The U.S. Fish and Wildlife Service (FWS) is charged with carrying out the Fish and Wildlife Coordination Act which was passed to provide wildlife conservation receiving equal consideration and coordination with other features of water resource development programs. In implementing this act, the FWS assists planners of water development projects receiving federal funding or requiring a federal permit in designing and operating projects so as to avoid or minimize adverse impacts to fish and wildlife. Where project impacts cannot be avoided, the FWS, in coordination with the Utah Division of Wildlife Resources, makes recommendations for appropriate mitigation and helps oversee implementation. The FWS is also charged with administering and regulating the Endangered Species Act. All federal agencies are charged with using their authorities to further the purposes of this act by carrying out programs for the conservation of threatened and endangered species.

The Bureau of Reclamation also works with state and local agencies to promote fish and wildlife activities at reservoirs constructed under reclamation law. The bureau develops facilities management plans for each project to promote sport fishing and optimize recreational opportunities. Potentially, the most important impact the federal government may have in the basin on fish and wildlife will be to fund environmental enhancement and mitigation projects of the Central Utah Project Completion Act.

14.4 Problems and Needs

Six problems are apparently affecting fish and wildlife in this basin. They are minimum instream flows, watershed protection, stream channel erosion, wetland's protection and enhancement, fisherman access, and water quality.

14.4.1 Minimum Instream Flows

Some streams cease flowing during drought years. Others such as Ashley Creek are substantially diverted for irrigation. These occurrences make it difficult to maintain a fishery.

The Instream Flow Agreement of 1980, as amended in 1990, provides 44,400 acre-feet of water made available by the Central Utah Project be released to maintain minimum flow conditions in streams for preventing unacceptable adverse impacts to fishery resources. These adverse impacts are caused by diversions to provide the water supply for the Central Utah Project. Minimum flows in Rock Creek, West Fork Duchesne River, Currant Creek and Strawberry River are provided to retain 50 percent of the historic adult trout habitat when the water is allowed to flow to the confluence of the Duchesne and Strawberry rivers. The CUPCA, Section 303(c)(5), requires a minimum instream flow of 15 cfs from Knight Diversion on the Duchesne River to the confluence of the Strawberry River as well as 15 cfs from Starvation Dam to the confluence of the Duchesne River. Section 505(d) provides for a minimum instream flow in Rock Creek of 29 cfs May through October and 23 cfs November through April at the Ute Indian Reservation boundary. The CUPCA, Section 303(a), also requires the minimum instream flows established pursuant to the Instream Flow Agreement. Instream flow for the 2-1/2 mile section of the Duchesne River above the confluence with the Green River is presently being analyzed for the protection of endangered fish species. Figure 5.4 in Section 5 of this basin plan shows minimum instream flows.

14.4.2 Watershed Protection

The Uinta Mountains and the desert south of the mountains are heavily used during the summer for recreation and grazing. Summer homes, ATV travel and livestock grazing along riparian corridors contribute to stream bank instability, reduce vegetation and increase the silt loading of streams. Also, elk and other wildlife destroy ditches, fences, irrigation systems and haystacks.

14.4.3 Stream Channel Erosion

High spring snowmelt causes erosion of the stream banks on Dry Fork, Ashley Creek and the Duchesne River. For example, the Dry Fork streambanks were highly eroded in 1997 with the breach of Mosby Canal and heavy snow melt. The canal failure resulted in an estimated 1-1/2 million cubic yards of debris being washed into the creek during the spring runoff. Other erosion is caused by cattle grazing on banks.

14.4.4 Wetlands Protection

Wetlands are threatened by urban growth and farming practices. Drainage from urban surfaces and farms threatens the quality and quantity of the water supplied to wetland resources.

14.4.5 Fisherman Access

Non-Indian access across Indian Lands is a major problem. Also, access to streams is limited across private lands. The U. S. Forest Service has blocked many old timber roads to Uinta Mountain lakes to protect wildlife and habitat.

14.4.6 Water Quality

Selenium in Ouray National Waterfowl Refuge, Stewart Lake, and the lower reaches of Ashley and Brush creeks has become a problem (see Section 12.4.2). There is also an anoxia problem at Pelican Lake.

14.5 Alternative Solutions

Title III of the Central Utah Project Completion Act calls for creation of the Utah Reclamation Mitigation and Conservation Commission. The commission's purpose is "to coordinate the implementation of the mitigation and conservation provisions the of CUPCA among the federal and state fish, wildlife and recreation agencies." Its duties are provided in Section 301 of the CUPCA. The commission's *Mitigation and Conservation Plan* was published in May 1997. It provides an overview of the planning process and explanations of its

programs, a budget and schedule for implementing projects and a monitoring program. The plan, updated yearly, was revised in May 1998.

Section 304 authorized completion of several fish and wildlife projects outlined in the *1988 Definite Plan Report* which have not been completed as of the date of enactment of the CUPCA. Section 305 directs the Utah Reclamation Mitigation and Conservation Commission to purchase big game winter rangelands to compensate for the impacts of federal reclamation projects in Utah. Big game crossings and wildlife escape ramps in large canals are also to be provided.

Water quality and fish and wildlife benefits could be realized if local sponsors (corporations, conservation organizations, cities, special service districts, Uintah, Duchesne and Daggett counties, state and federal agencies) could participate in joint ventures to enhance key wetlands in the Uintah Basin.

A state wetland protection plan is currently being prepared by the Governor's Office of Planning and Budget and natural resource agencies through the Resource Development Coordinating Committee working in conjunction with the Division of Wildlife Resources. High priority wetland areas throughout the state will be identified, and opportunities for protection and enhancement will be addressed. Ultimately, the value of wetlands and riparian land as discharge areas for flood events should be given greater consideration in flood control efforts at the city and county level. ❑

Content

Section 15
Uintah Basin Plan

Utah State Water Plan

Water-Related Recreation

The Uintah Basin provides some of the best water-based recreation in the state. People from all along the Wasatch Front use basin parks and reservoirs as their playground.

15.1 Introduction

Water is part of almost all recreation provided in the Uintah Basin, from skiing to golfing, to pools in municipal recreation centers, to flat water boating on major reservoirs. Design of water access and recreation features associated with water development projects are important components of water planning and development.

15.2 Setting

Five state parks in the basin received 308,340 visitors in 1997. The basin is traversed by U. S. Highway 40, connecting Salt Lake City to Denver, and by the old pack train road through Nine Mile Canyon in the Book Cliffs. Visitors to the area might visit Dinosaurland (Dinosaur National Monument), the Fremont Culture petroglyphs in Nine Mile Canyon, or Flaming Gorge National Recreation Area. Many campgrounds are provided in Ashley, Uinta and Wasatch national forests. Fishing and boating are the major recreation activities at Flaming Gorge, Strawberry, Currant Creek, Upper Stillwater, Starvation, Steinaker and Red Fleet reservoirs. The Green River below Flaming Gorge Reservoir offers some of the best fly fishing in the United States. Kayaking and white water rafting are also enjoyed on the Green River. Off-highway vehicles (OHVs) and biking are popular on Bureau of Land Management land, and wind surfing and sail boating is popular on Strawberry and Flaming Gorge reservoirs. Strawberry, Steinaker, Red Fleet and Flaming Gorge also provide excellent ice fishing during the winter. Developed state parks are located on Red Fleet, Starvation and Steinaker reservoirs. The Utah Field House of Natural History and Dinosaur Gardens is also a state park. Strawberry Reservoir is managed by the Forest Service. Flaming Gorge is a National Recreation Area. Mountain biking in the Ashley and Uinta National Forests is also available. Table 15-1 shows most of the recreation facilities in the basin, and Table 15-2 shows campgrounds.

15.3 Organizations and Regulations

Federal, state and local governments are active in managing recreation of all types. Public lands such as those managed by the Bureau of Land Management, Forest Service, National Park Service, Utah Division of Parks and Recreation, and other public and private providers create many opportunities. The Division of Parks and Recreation receives its authority from Title 63-11 of the Utah Code for planning, park designations, board powers, planning and development of recreation trails (Title 63-11a-101), boating law (Title 14-1-147) and OHVs (Title 41-22-1) among others. Water-related projects utilizing federal land and water conservation funds (LWCF) are protected from sale or conversion to other non-recreational uses by Public Law 88-578, Section 6(f).

15.3.1 Local

The Uintah Basin covers most of Dinosaurland and the Uinta Mountains. Among the many forms of recreation in the basin are hiking and backpacking, river running, rock collecting, back country 4x4 tours, biking, water skiing, fishing, boating and hunting. Fishing or hunting pack trips can be arranged anywhere from Spirit Lake on the

Table 15-1
Recreation Facilities in the Uintah Basin

Site Name	Elev. (feet)	Season	Recreation Opportunities
Bureau of Land Management			
Bridge Hollow	5500	Yearlong	Boating, Fishing
Indian Crossing	5500	Yearlong	Boating, Fishing
Pelican Lake	4800	Yearlong	Boating, Fishing
Dinosaur National Monument/NPS			
Deerlodge Park	5600	Summer	Permit Boating, Fishing
Echo Park	5100	Summer	Permit Boating, Fishing
Gates of Lodore	5400	Summer	Permit Boating, Fishing
Green River	4800	4/15-10/15	Limited Boating, Fishing
Rainbow Park	5000	Yearlong	Permit Boating, Fishing
Split Mountain	4800	10/16-4/14	Limited Boating, Fishing
Duchesne Ranger District/FS			
Aspen Grove	7000	5/25-9/30	Fishing
Hades	7100	5/25-9/30	Fishing
Iron Mine	7200	5/25-9/30	Fishing
Upper Stillwater	7700	5/15-9/30	Boating
Yellow Pine	7600	5/25-9/10	Boating
Flaming Gorge National Recreation Area/Ranger District/FS			
Antelope	6040	4/15-10/15	Campground, Marina at Lucerne
Antelope Flat	6100	5/17-9/12	View Wildlife and Scenery, Boating, Fishing
Arch Dam (Overflow)	6200	5/1-10/1	Green River
Browne Lake	8200	6/1-10/1	Fishing, Ute Tower. Dirt Road
Canyon Rim	7040	5/17-9/12	Visitor Ctr., Greens Lake, Red Canyon Lodge
Carmel	6500	5/15-10/1	Sheep Creek Geological Tour
Cedar Springs	6100	4/1-10/15	Cedar Springs Marina
Dam Spillway	5600	3/18-10/15	Green River Fishing/Floating
Dam Visitor Center	6050	Yearlong	Dam Tour, Swett Ranch Historic Site
Deep Creek	7800	6/1-10/1	Carter Creek, Ute Tower. Dirt Road
Deer Run	6200	5/17-10/15	Cedar Spring Marina
Dowd Mtn. Overlook	8000	5/1-10/1	Scenery and Wildlife Viewing. Dirt Road
Dowd Spr. Rest Area	7600	5/1-10/1	Ute Tower
Dripping Springs	6000	Yearlong	Green River Fishing and Rafting
Dutch John Draw	6100	5/1-11/1	Seclusion, Lake Access. Dirt Road
Firefighter's Mem.	6900	5/17-9/12	Green Riv., Cedar Spring Marina, Amphitheater
Gooseneck	6040	5/17-9/12	Fishing/Boating, Scenery, Lk. Flaming Gorge
Greendale	7000	5/1-10/1	Green R., Cedar Spring Marina, Amphitheater
Greendale East	7000	5/1-10/1	Green R., F.G. Lodge, Bootleg Amphitheater
Green's Lake	7400	5/17-11/1	Visitor Center., Greens Lake, Red Canyon Lodge
Hideout Canyon	6040	5/17-9/12	Fishing/Boating, Scenery, Lake Flaming Gorge
Jarvies Canyon	6040	5/17-9/12	Fishing/Boating, Scenery, Lake Flaming Gorge
Kingfisher Island	6040	5/17-9/12	Fishing/Boating, Scenery, Lake Flaming Gorge

Table 15-1 (Continued)
Recreation Facilities in the Uintah Basin

Site Name	Elev. (feet)	Season	Recreation Opportunities
Flaming Gorge National Recreation Area/Ranger District/FS (Cont.)			
Little Hole	5600	Yearlong	Green River Fishing, Rafting and Scenery
Lucerne	6040	4/15-10/15	Marina, Campground
Lucerne Beach	6040	Yearlong	Near Lucerne Campground and Marina
Lucerne Point	6100	5/1-10/1	Marina, Boating, Fishing, View Wildlife
Lucerne Valley	6100	4/9-10/15	Marina. Note: Fee as of 1994.
Manns	6050	4/1-11/1	On Sheep Creek. Free fishing and scenery.
Mustang Ridge	6200	5/17-9/12	Sunny Cove Swim Beach
Navajo Cliffs	6500	5/15-10/1	Sheep Creek Geological Tour
Palisades	7000	5/15-10/1	Sheep Creek Geological Tour
Red Canyon	7400	5/17-10/1	Red Canyon Visitor Center, Lodge
Sheep Creek Bay	6040	4/1-11/15	Fishing/Boating on Lake Flaming Gorge
Sheep Creek Lake	8600	6/1-10/1	Boating, Fishing, Access to Lake. Dirt Road
Skull Creek	7600	5/17-9/12	Red Canyon. Visitor Center, Greens Lake, Trailhead
Spirit Lake	10200	6/1-10/1	High Uintas, Fishing, High Lakes Access.
Stateline Cove	6040	Yearlong	Free Camping on Lake Shore (North of Lucerne)
Sunny Cove	6040	5/17-9/13	Near Mustang Campground and Dutch John
Willows	6060	4/1-11/1	On Sheep Creek. Free fishing and camping.
Roosevelt District/FS			
Bridge	7700	5/25-9/10	Fishing
Moon Lake	8100	5/25-9/10	Swimming, Boating, Fishing
Pole Creek Lake	8200	7/1-9/10	Fishing
Reservoir	7900	5/25-9/10	Fishing
Riverview	8000	5/25-9/10	Fishing
Swift Creek	8100	5/25-9/10	Fishing
Uinta Canyon	7600	5/25-9/10	Fishing
Wandin	7700	5/25-9/10	Fishing
Yellowstone	7700	5/25-9/10	Fishing
State Parks			
Big Sand Wash	5900	Yearlong	Boating, Fishing (not developed)
Utah Field House of Natural History	5400	Yearlong	Museum/Dinosaur Garden
Red Fleet	5500	Yearlong	Swimming, Boating, Fishing, Camping
Starvation	5700	Yearlong	Swimming, Boating, Fishing, Camping
Steinaker	5500	Yearlong	Swimming, Boating, Fishing, Camping
Vernal Ranger District/FS			
East Park	9000	6/1-10/31	Boating, Fishing
Kaler Hollow	8900	6/1-10/31	Fishing
Lodgepole	8100	5/25-9/10	Fishing
Oaks Park	9200	6/1-10/31	Boating, Fishing
Paradise Park	10000	6/15-10/31	Boating, Fishing
Red Springs	8100	5/25-10/31	Fishing
Whiterocks	7400	5/15-10/31	Fishing

Table 15-2
Campgrounds

Campground Name	Location	Elevation (feet)	Season
Dinosaur National Park/NPS			
Green River	Jensen	4800	Summer
Rainbow Park	Vernal	5000	Summer
Flaming Gorge National Recreation Area			
Firehole Canyon	Dutch John	6100	Summer
Antelope Flat	Dutch John	6100	Summer
Mustand Ridge	Dutch John	6200	Summer
Dripping Springs	Dutch John	6000	Summer
Cedar Springs/Deer Run	Dutch John	6200	Summer
Fire Fighters Memorial	Greendale	7300	Summer
Green's Lake	Canyon Rim	7400	Summer
Lucerne Valley	Manila	6100	Summer
Buckboard Crossing	Manila	6100	Summer
Hideout Boot Camp	Manila	6100	Summer
Forest Campgrounds/FS			
Bridge	Altamont	7700	5/25-9/10
Moon Lake	Altamont	8100	6/1-9/10
Reservoir	Altamont	7900	5/25-9/10
Riverview	Altamont	8000	5/25-9/10
Swift Creek	Altamont	8100	5/25-9/10
Yellowstone	Altamont	7700	5/25-9/10
Avintaquin	Duchesne	8800	5/25-9/10
Miners Gulch	Duchesne	7500	5/25-9/10
Yellow Pine	Duchesne	7600	5/25-9/10
Arch Dam (overflow only)	Dutch John	6200	5/31-9/5
Canyon Rim	Dutch John	7400	5/12-9/12
Deer Run	Dutch John	6200	5/20-9/12
Gooseneck (boat access)	Dutch John	6100	Yearlong
Green's Lake	Dutch John	7400	5/20-9/12
Greendale (group site)	Dutch John	7000	5/17-10/1
Greendale	Dutch John	7000	5/20-12/31
Red Canyon	Dutch John	7400	5/25-9/5
Skull Valley	Dutch John	7600	5/20-9/12
Jarvies Canyon	Flaming Gorge	6100	6/7-12/31
Hades	Hanna	7100	5/25-9/10
Aspen Grove	Hanna	7000	5/25-9-10
Iron Mine	Hanna	7200	5/25-9/10
South Fork	Hanna	8000	5/25-9/10
Currant Creek	Duchesne	8000	5/25-10/31
Strawberry Bay	Duchesne	7700	5/25-10/31
Bridger Lake	Duchesne	9300	6/1-10/31
China Meadows	Duchesne	9500	7/1-9/15
Campground Stillwater	Duchesne	8500	6/1-9/15
Christmas Meadows	Manila	8800	6/15-9/15
Henry's Fork Trailhead	Manila	8900	6/1-10/31
Hoop Lake	Manila	9000	6/15-9/30

Table 15-2 (Continued)
Campgrounds

Campground Name	Location	Elevation (feet)	Season
Forest Campgrounds/FS (Continued)	Manila	9800	6/26-9/10
Lily Lake	Manila	9200	6/15-9/15
Little Lyman Lake	Manila	9400	7/1-9/15
Marsh Lake	Manila	8700	6/15-9/15
Meeks Cabin	Manila	9200	7/1-9/15
Stateline Reservoir	Lapoint	10000	6/15-10/31
Paradise Park	Manila	8200	6/1-10/1
Browne Lake	Manila	6100	5/25-9/10
Buckboard Crossing	Manila	7800	6/1-10/1
Deep Creek	Manila	6100	5/20-9/12
Hideout (boat access)	Manila	6100	4/1-12/31
Kingfisher Island (boat access)	Manila	6100	5/17-9/12
Lucerne Valley	Manila	6100	5/20-9/12
Lucerne Point (group site)	Manila	10000	6/1-9/12
Spirit Lake	Roosevelt	10200	7/1-9/10
Pole Creek Lake	Roosevelt	7600	5/25-9/10
Uinta Canyon	Roosevelt	7700	5/25-9/10
Uinta River	Roosevelt	7700	5/25-9/10
Wandin	Vernal	8000	5/25-10/31
Iron Springs	Vernal	8100	5/25-9/31
Red Springs	Vernal	9000	6/1-10/31
East Park	Vernal	8900	6/1-10/31
Kaler Hollow	Vernal	7800	5/25-10/31
Lodgepole	Vernal	9200	6/1-10/15
Oaks Park	Vernal	8290	6/1-10/31
BLM Campgrounds			
Bridge Hollow	Dutch John	5700	Yearlong
Indian Crossing	Dutch John	5700	Yearlong
Pelican Lake	Roosevelt	4800	4/1-11/1
Dry Fork	Vernal	6500	6/1-10/1
Commercial Campgrounds			
Boys Ranch	Altamont	6500	Yearlong
Dinosaur Village RV Campground	Jensen	5280	4/1-10/31
Flaming Gorge KOA	Manila	6400	4/15-11/15
Fossil Valley RV Park	Vernal	5200	4/1-11/1
Vernal KOA	Vernal	5300	5/1-9/30
Western Heritage RV Park	Vernal	5260	4/1-10/30

north slope to the Duchesne and Uinta rivers on the south slope.

River-running companies provide white water adventure on the Green and Yampa rivers. Also, private float trips can be arranged through the Forest Service, Park Service and BLM.

Float fly-fishing below Flaming Gorge Dam is provided by tour companies from Dutch John and Flaming Gorge Lodge. Also, rafts can be rented or private rafts used to float and fish the Green River. You can also fish a seven-mile long stretch from the dam to Little Hole from a trail provided by the Forest Service. The Flaming Gorge National Recreation Area has provided launching and landing facilities below the dam and along the Green River.

Public stream fishing[37] and hunting, as well as trophy fishing and private hunting clubs, are provided throughout the basin.

Uintah County has been developing a biking trail system, from easy to difficult, on the hills of the lower valleys as well as in the forested areas. Local parks in the basin have received LWCF matching dollars of more than $855,000 for 12 projects (eight in Duchesne and four in Uintah County), including two new swimming pools, a golf course and park improvements, for total project cost of $1.71 million.

15.3.2 State

The Utah Division of Parks and Recreation has responsibility for conserving Utah's rich natural resource heritage while making its recreational opportunities available to the resident and nonresident user. The mission of the division is to enhance the quality of life in Utah through parks, people and programs. The division also manages five state parks; coordinates four grant funding programs; manages OHV, boating and trails programs; and prepares the *Statewide Comprehensive Outdoor Recreation Plan* (SCORP). The Division of Wildlife Resources plants millions of fish in the reservoirs and in the High Uinta lakes. It performs law enforcement and big game management functions in the entire basin.

15.3.3 Federal

The Bureau of Reclamation (CUP) constructed impoundments on the Strawberry, Duchesne and Green rivers and also on Currant, Rock, Ashley and Brush creeks. These impoundments, built primarily for agricultural and culinary use, have become an integral part of the recreational picture for Utahns.

15.4 Outdoor Recreational Facilities and Use

Local, state and federal agencies all play a role in fulfilling the demand for recreational facilities and managing their uses. Water may be incidental or crucial to public and private recreation facilities.

15.4.1 Local Facilities

City and county recreational facilities range from golf courses to picnic tables. Every golf course uses millions of gallons of water annually for maintenance. Local recreation providers commonly use water in aquatic programs, beyond landscaping needs. The Uintah Basin has three golf courses, and there are seven commercial campgrounds. Under the Central Utah Project, public access will be developed at specific sites along the Uinta, Yellowstone, Lake Fork, Strawberry, West Fork Duchesne, and Duchesne rivers and Currant Creek.

15.4.2 State Parks[107,152]

The Utah Division of Parks and Recreation manages the Red Fleet, Starvation, Steinaker, Big Sand Wash, Utah Field House of Natural History and Dinosaur Gardens state parks. The division completed its *Frontiers in 1997: A System Plan to Guide Utah State Parks and Recreation into the 21st Century*. This 39-page document was the result of broad public input during 1995 and 1996. Five major issues are addressed for each of three primary components -- parks, people and programs. Currently, the top issues for the division are funding, planning and partnerships. A section on boating calls for 11 possible strategies. The concern is establishing carrying capacities on Utah waters for vessels, continuing an education program for water quality and safety, working closely with the boating industry, and controlling the personal water craft problems on boating waters. The Partnership Section identifies the importance of working with the State Water Planning Process and coordinating planning, development and management. Table 15-3 illustrates the natural resource base and use of state parks managed by the division. Four major boat-launching ramps are available to the public. They are located at Red Fleet, Steinaker Big Sand Wash and Starvation reservoirs. Big Sand Wash is undeveloped. Water levels on the reservoirs will fluctuate, leaving mud flats exposed during periods of heavy demand on their water supplies.

15.4.3 Federal Parks and Facilities[141,87]

More than 70 campgrounds are within the national forests in and near the basin. Many are full-service campgrounds with approved water systems. Some have lakes and streams nearby for fishing and other recreational activities. The Uinta Mountains contain hundreds of excellent trout lakes and a primitive area.

Table 15-3 State Parks Visitation And Area			
Park Name	1997 Visitation	Water Area (acres)	Camping Units
Big Sand Wash	Undeveloped	390	Undeveloped
Natural History Field House	90,040	--	Museum
Red Fleet	52,900	520	29
Starvation	98,690	2,760	35
Steinaker	66,710	830	31
Total	308,340	4,500	

Flaming Gorge Reservoir and the Green River are managed by the U. S. Forest Service as part of Flaming Gorge National Recreation Area. The Forest Service also manages recreation facilities at the enlarged Strawberry Reservoir.

Flaming Gorge National Recreation Area, established in 1964, encompasses the 91-mile long reservoir and more than 700,000 acres of magnificent canyon lands and mountains. Recreational opportunities include trophy fishing, power boating, hunting, camping, hiking and river rafting, as well as superb fat-tire bicycle riding and thin-tire bicycle touring. Inquire at the visitor center at the dam for more information.

The region is a geologic treasure trove with craggy rocks jutting toward the heavens along the Sheep Creek Geological Loop. They tell the story of the earth over millions of years, as fissures, faults and other formations bare the soul of the region's past. The lake and river below the dam have since become one of the West's finest fishing and boating areas.

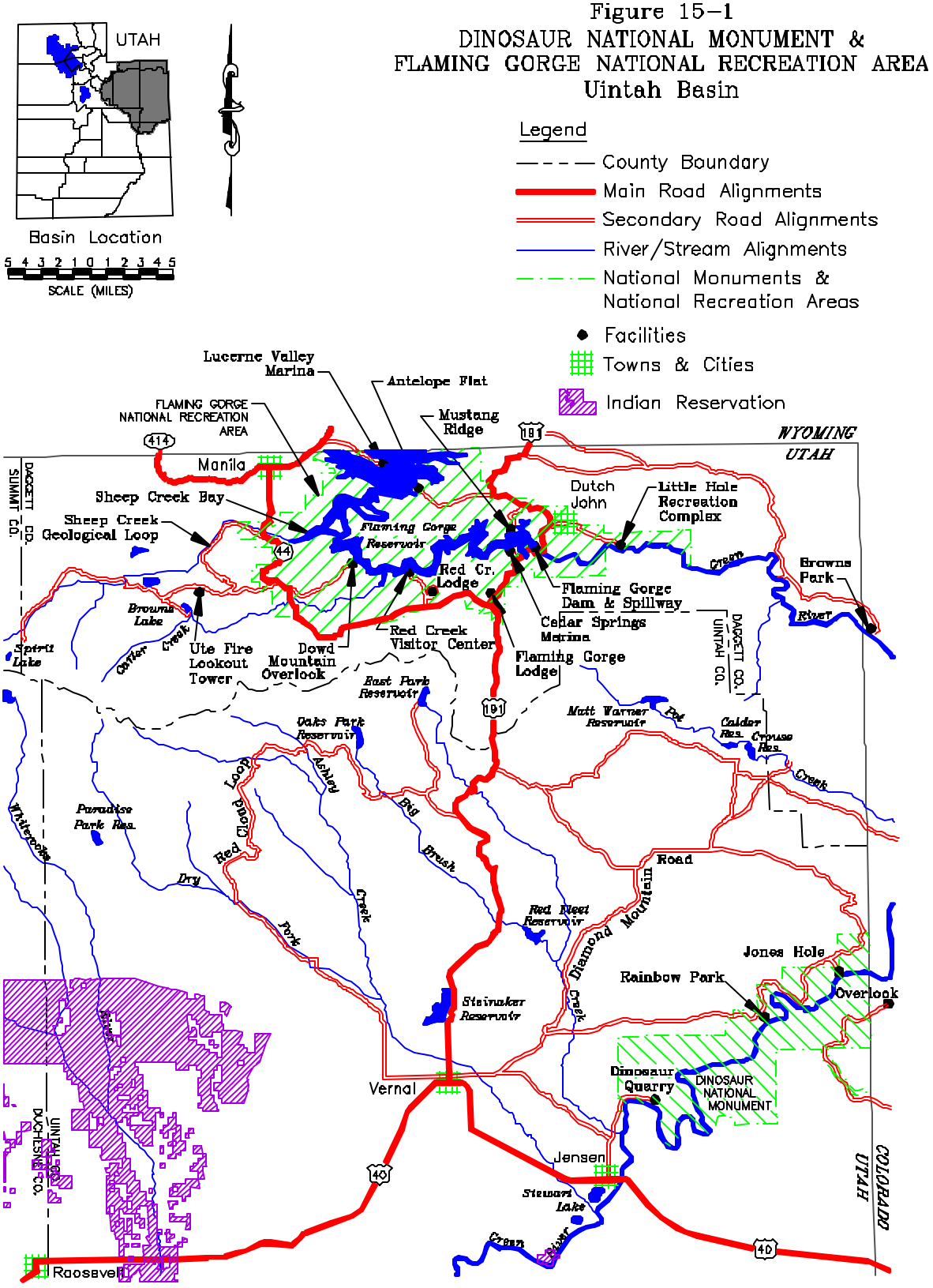
Dinosaur National Monument,[88] located 20 miles east of Vernal, is the dinosaur quarry lending its name to all of Dinosaurland. Discovered in 1909 by paleontologist Earl Douglass, the quarry is the largest Jurassic Period dinosaur quarry in the world. One entire wall of the glass quarry building is a fossilized sand bar that collected dead dinosaurs as they were swept down an ancient river.

Originally established on 80 acres in 1915, the monument was enlarged in 1938 to include more than 200,000 acres of wilderness in Utah and Colorado. Included are the spectacular canyons of the Green and Yampa rivers. Fortunately, biking, hiking, camping and white water rafting opportunities are plentiful. Figure 15-1 shows the Flaming Gorge National Recreation Area and Dinosaur National Monument.

15.5 Recreational Activity Problems and Needs

Two major public opinion surveys were initiated in 1994 and completed in early 1995. These were the *Community Assessment Survey on Tourism and Recreation - Final Report*, Wasatch County 1994, and the *Telephone Survey*, Utah Division of Parks and Recreation, January 6, 1995. Among the many findings are: 1) Ninety percent of the state's population has visited an average of eight Utah State Parks, 2) most respondents had visited three to four parks in the last year, 3) 87 percent felt it inappropriate to sell all or portions of state parks, 4) more than 75 percent felt additional lands should be acquired for new state parks, 5) condemnation of private lands for parks was disfavored by 75 percent of the public, 6) 65 percent agreed that fees for campgrounds and picnicking areas should be increased, and 7) over two-thirds felt parks should limit entry when the capacity of the park is reached.

Figure 15–1
DINOSAUR NATIONAL MONUMENT & FLAMING GORGE NATIONAL RECREATION AREA
Uintah Basin



The community assessment found: 1) tourism encourages investment in the local economy and environmental impacts are relatively minor, 2) there was strong sentiment that the residents should be heavily involved in all planning processes in their county, and 3) the counties should develop plans to manage the growth of tourism and recreation.

Recreation agencies in local and state government keep up with recreation planning by participating in the *Statewide Comprehensive Outdoor Recreation Plan* (SCORP). On a five-year cycle, it analyzes the supply and demand issues associated with outdoor recreation.

Surveys conducted in support of the SCORP process help to identify the most popular individual and family outdoor recreation activities. Tables 15-4 and 15-5 show these relationships.

15.6 Issues And Recommendations

This sub-section discusses two major issues: outdoor ethics and comprehensive planning.

15.6.1 Outdoor Ethics

Issue - Many conflicts are exacerbated by unethical behavior in recreational settings.

Discussion - One common ethics/use conflict is the operation of personal water craft without regard for other users' safety or recreation experiences. The popularity of the activity has boating safety managers grappling with different solutions.

Some success with this and other problems has been achieved through such programs as "Tread Lightly" and the Utah Division of Wildlife Resources hunter education and off-highway vehicle (OHV) and water craft safety programs. The continuation of education and enforcement programs based on principled behavior is crucial. More than 1,000 youth have been trained and certified on personal water craft and more than 10,000 for OHVs.

Recommendation - The Division of Parks and Recreation, in cooperation with other recreation agencies, should organize focus groups with recreationists and managers from throughout the state to obtain ideas and support from all members of the recreation community. People who create the conflicts should be represented and encouraged to participate.

Natural History Museum in Vernal

15.6.2 Comprehensive Planning

Issue - Comprehensive planning for allocation of resources in this basin is vital.

Discussion - This basin plan represents a sampling of the state's initiative in addressing challenges. The Bureau of Reclamation recently completed a resource management plan for Starvation Reservoir. The Division of Parks and Recreation is doing park planning on all of the areas it manages around the state. The Forest Service has completed Resource Management Plans for Strawberry Valley and Diamond Mountain. The BLM is updating its *Book Cliffs Resource Management Plan*. Recreation planning and water access should continue to be factored into projects such as the Upalco and Uintah Replacement Projects.

Table 15-4
Favored Individual Outdoor Recreation

Rank	Activity	Rank	Activity
1	Fishing[a]	23	Cross-Country Skiing
2	Walking	24	Jog/Running
3	Camping	25	Photography
4	Golf	26	Horse Activities
5	Picnicking	27	Off-Highway
6	Driving/Sight-	28	Motorcycling
7	Seeing	29	Water Play/Sun Bathing
8	Hunting	30	Skeet/Target Shooting
9	Visit Historic Sites	31	Horseshoes
10	Camping - Primitive	32	Sledding/Tubing
11	Downhill Skiing	33	Field Sports
12	Hiking	34	Backpacking
13	Pool Swimming	35	Canoe/Kayak/Rafting
14	Bicycling	36	Ice Skating
15	Water Skiing	37	4-Wheeling (4X4s)
16	Wildlife/Nature	38	Playground Activities
17	Study	39	ATV Activities
18	Baseball/Softball	40	Sail Boarding
19	Attend Events	41	Other Activities
20	Volleyball	42	Rock Climbing
21	Power Boating	43	Snowmobiling
22	Basketball	44	Highway Motorcycling
	Tennis		Archery
	Mountain Biking		

[a]44 percent of all survey respondents listed fishing as one of their top five favorite outdoor activities.

Table 15-5
Favored Family Outdoor Recreation

Rank	Activity	Rank	Activity
1	Camping - Developed	23	Cross-Country Skiing
2	Picnicking	24	Baseball/Softball
3	Fishing[a]	25	Volleyball
4	Driving/Sightseeing	26	Photography
5	Pool Swimming	27	Mountain Biking
6	Walking	28	Horse Activities
7	Visit Historic Sites	29	4-Wheeling (4X4s)
8	Hiking	30	Tennis
9	Downhill Skiing	31	Jogging/Running
10	Golf	32	Ice Skating
11	Camping - Primitive	33	Canoe/Kayak/Rafting
12	Power Boating	34	Back Packing
13	Attend Events	35	ATV Activities
14	Playground Activities	36	Highway Motorcycling
15	Waterskiing	37	Snowmobiling
16	Hunting	38	Off-Highway
17	Wildlife/Nature Study	39	Motorcycling
18	Bicycling	40	Sail Boarding
19	Basketball	41	Jet Ski
20	Sledding/Tubing	42	Skeet/Target Shooting
21	Water Play/Sun	43	Archery
22	Bathing		Other Activities
	Field Sports		

[a]32 percent of all survey respondents listed fishing as one of their top five favorite outdoor activities.

Recommendation - The Division of Parks and Recreation should continue to implement findings of the *Uintah and Diamond Mountain Resource Management Plans* and the *Flaming Gorge National Recreation Area Management Plan* to balance use and resource capacity to achieve sustainability of water resource uses for recreation. ❑

Content

Section 16
Uintah Basin Plan

Utah State Water Plan

Federal Water Planning and Development

The role of the federal government is changing from one of construction and development to one of preservation, conservation management and maintenance. Federal funding of construction and development is decreasing, while regulatory programs are increasing.

16.1 Introduction

Although the activities of federal agencies are changing, many historical programs are still available. To use them, local people must be informed about program functions and how to gain access. With this information, better interagency and local working relationships are possible. To this end, a brief description of various agency programs is given.

First major spill at Upper Stillwater Dam, June 30, 1995

16.2 Background

With an increase in regulatory requirements and congressional attempts to balance the budget, gaps in technical assistance and funding may occur. Frequently, federal requirements of higher standards for resource uses without additional funds add costs to state and local budgets. This reduces the state and local funds for carrying out water resource conservation and development programs.

16.3 Federal Programs

Various federal agencies and their programs are briefly described below.

16.3.1 Bureau of Land Management

The Federal Land Policy and Management Act gives the Bureau of Land Management (BLM) authority to inventory and comprehensively plan for all public lands and resources under its jurisdiction, including water. It is also responsible for managing the wilderness areas and wild and scenic and recreational rivers on BLM land. There are wilderness and primitive areas in the Uintah Basin.

Water resources are rapidly becoming a major determinant of resource management alternatives. Quality and quantity of water are now major elements of resource management plans (RMPs) as the BLM manages riparian habitats of streams, lakes, reservoirs and ponds on its lands. Public lands in Daggett, Duchesne and Uintah counties are within the BLM Vernal District.

Completed resource management plans[119] in the Uintah Basin exist for Book Cliffs (1985), Nine

Mile Canyon (1997)[109] and Diamond Mountain (1993).[110] An Environmental Impact Statement for the White River Dam Project was completed in 1975, and an Environmental Assessment Planning Amendment for the lands acquisition in Nine Mile Canyon was completed in 1997.

16.3.2 Bureau of Reclamation (BR)

Three broad categories of water resources programs are administered by the BR. They are investigation, research and service -- all requiring close cooperation with concerned citizens.

Investigation Programs - General investigations are conducted for single and multipurpose water projects. Environmental assessments are usually included.

Research Programs - The BR conducts research on water project design, construction and materials. Research is also carried out on atmospheric management, as well as geothermal and solar power. Most programs are conducted in cooperation with other entities. Early in the Central Utah Project, the BR studied the feasibility of hydroelectric generation at the Split Mountain and Desolation Canyon Dam sites. Feasibility was better at the Flaming Gorge site where the dam was built.

Loan Programs - These programs have provided federal loans to qualified organizations wishing to construct or improve smaller and generally less complex water resources infrastructures. The BR has recently reassessed its loan programs and concluded that they need major redirection. As a result, the BR is no longer accepting applications for loans.

Service Programs - These programs are designed to provide data, technical knowledge and expertise to state and local governmental agencies. They aim to avoid duplication of special service functions. Local governments pay for these services.

Project Construction - The BR is phasing out its project construction programs. Constructions of Jordanelle Dam and Sixth Water Aqueduct were probably the last major projects for the BR in Utah. The Central Utah Project Completion Act transferred authority for constructing remaining elements of the Central Utah Project to the Central Utah Water Conservancy District.

16.3.3 The U. S. Army Corps of Engineers (COE)

If local entities are unable to deal with a large water resources problem, they may petition their congressional representatives for COE assistance under the Civil Works-General Investigation Authority. They may request assistance with smaller problems directly from the local COE office under the Continuing Authority Program. This allows the COE to investigate the economic, technical, social and environmental acceptability of remedial measures. When the directive covers an entire river basin, the COE studies it as a unit and prepares a comprehensive plan. Close coordination is maintained with local interests, the state and other federal agencies.

Numerous water resources studies have been conducted and several projects built within the basin. Recent studies include the Duchesne River and Ashley River investigations. A streambank protection project along the Duchesne River near Duchesne was completed in November 1990. A Reconnaissance Investigation of Ashley Creek and a Clearing and Snagging Project along a 12-mile reach between Highway 191 and Ashley Spring were completed in 1965. Also, the city of Vernal received emergency assistance during the 1983-1984 flooding. The CUWCD is assisted by the COE in the flood control operation of Red Fleet and Flaming Gorge reservoirs.

The COE, in cooperation with the Bureau of Reclamation and the Central Utah Water Conservancy District, has established specific operating criteria for Flaming Gorge Reservoir during periods of high runoff and flooding. Under this authority, known as Section 7, the COE also monitors the operation on a real-time basis.

The COE also has emergency assistance authorities. Requests for emergency assistance should be made through the Utah Division of Comprehensive Emergency Management.

Thornberg Diversion

16.3.4 Environmental Protection Agency (EPA)

Environmental Protection Agency programs include safe drinking water under the Safe Drinking Water Act and water pollution control under the Clean Water Act. The Safe Drinking Water Act increased the number of regulated drinking water contaminants. It added new required treatment methods and made other revisions. Congress is currently considering the act for re-authorization. Important aspects of the Clean Water Act include the National Pollutant Discharge Elimination System (NPDES) Section 402 which regulates the discharge of point sources of pollutants to waters of the United States.

Construction grants originally provided funds for construction of needed municipal wastewater treatment facilities. This program was phased out in 1990 and replaced with a revolving loan fund managed by the states.

Water quality management planning and non-point source pollution control, Section 604(b), provides funds to states to carry out water quality management planning. Section 319 of the act authorizes funding for implementation of non-point source pollution control measures under state leadership.

16.3.5 Federal Emergency Management Agency (FEMA)

FEMA programs are directed to disaster preparedness, assistance and mitigation. They provide technical assistance, loans and grants.

Presidential-Declared Disaster - After the president declares a major disaster, usually following a governor's request, grants are available to state and local governments for mitigation.

Assistance Grants - The FEMA can provide matching grants to help states develop and improve disaster preparedness plans and develop effective state and local emergency management organizations. Also, grants are available to develop earthquake preparedness capabilities.

Flood Plain Management - The FEMA provides technical assistance to reduce potential flood losses through flood plain management. This includes flood hazard studies to delineate flood plains, advisory services to prepare and administer Flood plain management ordinances and assistance in enrolling in the National Flood Insurance Program. The FEMA can also help with the acquisition of structures in flood plains subject to frequent flooding.

16.3.6 Fish and Wildlife Service (FWS)

The FWS carries out many of the mandates of the Endangered Species Act, Fish and Wildlife Coordination Act, Clean Water Act and the Migratory Bird Treaty Act. The FWS manages the Ouray National Wildlife Refuge and Jones Hole National Fish Hatchery.

The FWS is the federal agency with responsibility for ensuring the long-term conservation and protection of certain federal trust resources, including threatened and endangered species, migratory birds, wetlands, and fish and wildlife resources that may be impacted by federally permitted or funded projects. Additionally, the FWS manages fish and wildlife habitat in the National Wildlife Refuge system. The FWS's authorities come from the Endangered Species Act, the Clean Water Act, the Migratory Bird Treaty Act, the Bald Eagle Protection Act, the Fish and Wildlife Coordination Act, the National Environmental Policy

Act, and the National Wildlife Refuge System Administration Act.

The FWS compiles lists of animal and plant species native to the United States that are being reviewed for possible addition to the List of Endangered and Threatened Species. Such species are generally referred to as Candidate Species. Candidate Species are those for which the FWS has sufficient information on biological vulnerability and threats to support addition to the list. Species considered threatened or endangered in the Uintah Basin are given in Table 16-1. These lists change over time as other species are added when they become threatened or are removed when they recover. When any activity is planned which may affect a threatened or endangered species, it is the responsibility of the sponsor of the activity or project to take actions to protect them.

When right-of-way permits are required on federal lands, the consultation requirement under the Fish and Wildlife Coordination Act is actuated. If federal funds are involved, Section 7 consultation with the FWS is required by the Federal Endangered Species Act (also see Section 14 of this basin plan). Section 404 permitting under the Clean Water Act, as administered by the Corps of Engineers, calls for the FWS to respond on impacts to wetlands and on threatened or endangered species. Under the Migratory Bird Treaty Act, all birds are protected except starlings, English Sparrows and pigeons.

Table 16-1
Candidate and Listed Species

Candidate Species	Listed Species	Category
Canada lynx	Razorback sucker	Endangered
Pariette cactus	Bonytail chub	Endangered
Mountain plover	Colorado pike minnow	Endangered
Grahm beard tongue	Whooping crane	Endangered
Horseshoe milkvetch	Humpback chub	Endangered
White R. beard tongue	Bald eagle	Threatened
	Black-footed ferret	Endangered
	Ute ladies-tresses orchid	Threatened
	Barneby ridge-cress	Endangered
	Shrubby reed-mustard	Endangered
	Uinta Basin hookless cactus	Threatened
	Clay reed-mustard	Threatened
	Mexican spotted owl	Threatened
	Southwestern willow flycatcher	Endangered

The Endangered Species Act also prohibits the "taking" of a protected species. Any unpermitted activity on any land that results in taking of federally listed species constitutes violation of Section 9 of the Endangered Species Act. "Taking" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempting to engage in any such conduct. This can include significant habitat modification or degradation where it kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

16.3.7 The U. S. Forest Service (FS)[100,101,103]

Water-related programs of the FS include watershed management, special use authorization for water development projects, and coordination with local, state and federal agencies. They also manage wilderness areas on national forest lands.

Watershed Management - Watershed protection insures that activities do not cause undue soil erosion and stream sedimentation, do not reduce soil productivity, or do not otherwise degrade water quality. Water yields may be affected primarily through snowpack management because of timber harvest using well-planned layout and design. Potential increases may approach one half acre-foot per acre for some treated areas, but multiple-use considerations and specific onsite conditions may limit actual increases.

Special Use Authorization - Construction and operation of reservoirs, conveyance ditches, hydropower facilities and other water developments require special use authorization and an annual fee. Authorization contains conditions necessary to protect all other resource uses. Coordination of water developments by others requires communication early in the planning process to guarantee environmental concerns are addressed. The FS has prepared a *Resource Management Plan* along with a Monitoring and Evaluation Program for the Uintah National Forest. Also, a Record of Decision for oil and gas leasing in the Western Uintah Basin was completed in 1997.[99]

High Uinta Wilderness Area

The FS is developing a plan to manage the High Uinta Wilderness Area in a manner that protects wilderness values while providing for compatible human use. Enlargement of the existing wilderness area is being studied. The draft document, completed in 1998, was criticized by a number of environmental groups as inadequate.

National Wild and Scenic Rivers System

A Draft Inventory of Rivers on the Uintah National Forest eligible for inclusion in the National Wild and Scenic Rivers System was completed by the FS in 1997. No sections of streams in the Uintah National Forest within the Uintah Basin are eligible for the National Wild and Scenic Rivers Program.

Forest Plan

The FS has completed a *Land and Resource Management Plan* for the Ashley National Forest.[103] The forest is administered by the Forest Service and covers approximately 1.3 million acres within the boundaries of Uintah, Duchesne, Daggett, Summit and Wasatch counties. This *Land and Resource Management Plan* will guide all natural resource management activities and establish management standards and guidelines for the Ashley National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management.

16.3.8 U. S. Geological Survey (USGS)[142]

The USGS, through its Water Resources Division, investigates the occurrence, quantity, distribution, and movement of surface and groundwater. It also coordinates federal water data acquisition activities.

The USGS cooperates with various state and local agencies and other federal agencies. Programs include water quality and groundwater. They read and evaluate surface water stream gages. The agency includes the Biological Survey.

16.3.9 Natural Resources Conservation Service (NRCS)[105]

The NRCS provides technical and financial assistance to conserve soil, water and related resources on non-federal land through local soil conservation districts. In addition to working with

individual landowners and units of government, the NRCS administers the programs described below:

- Published soil surveys contain descriptions of an area's soils, their uses and management, and maps depicting the extent of these soils. The surveys give information about non-federal lands.

- Through the snow survey program, the NRCS measures snow water equivalent and precipitation at 33 snow course sites (20 of which are SNOTEL sites) with locations ranging in elevation from 7,900 feet to 11,100 feet. These data are available to the public electronically. Basin outlook reports that compare current snowpack, precipitation and reservoir storage to average amounts and forecast stream flows are published January through June. The NRCS cooperates with the National Weather Service in making streamflow and flood forecasts.

- River basin studies - Technical and financial assistance for watershed protection and flood prevention and the emergency watershed protection program were all authorized by the Small Watershed Protection and Flood Prevention Program (PL-566). The Emergency Watershed Protection Program provides immediate technical and financial assistance to relieve hazards to life and property resulting from conditions created by natural disasters.

- Watershed Protection and Flood Prevention Studies (PL-566) were completed for the Dry Fork Project in east-central Duchesne and west-central Uintah counties, Hancock Cove Watershed Project, Martin Lateral and Coyote Wash. Reservoirs were proposed for Blanchett Park and Twin Lakes on the Dry Fork as well as the Crow Creek site on the Deep Creek drainages in Uintah County.

- Rural Development in Utah operates programs through the USDA Rural Housing Services Community Facilities Program that can provide loan funds for watershed improvements and hydroelectric plants.

16.3.10 Farm Service Agency (FSA)

The FSA administers the following programs:

- Agricultural Market Transition Program
- Commodity Loan Programs
- Commodity Purchase Programs
- Non-Insured Crop Disaster Assistance Program
- Farm Loans
- Conservation Programs

The Agricultural Market Transition Program is a program for farmers who participated in the prior Wheat and Feed Grain Program and allows eligible farmers to enter into seven-year production flexibility contracts and receive a series of fixed annual "transition payments." The purpose of the program is to transition producers who have been earning deficiency payments from government-driven planting decisions to market-driven planting decisions.

The Commodity Loan Programs provide producers who have entered into a production flexibility contracts interim financing by making non-recourse loans. The crop itself is used for collateral. Non-recourse means that the producer can discharge debts in full by forfeiting or delivering the commodity to the government. At any time during the term of the loan, the producer can sell the commodity and use the proceeds to repay the loan.

Commodity Purchase Programs are administered through the Commodity Credit Corporation (CCC). The FSA operates the CCC which acquires commodities that are forfeited under the Commodity Loan Programs. Also, under the dairy price support program, the CCC buys surplus butter, cheese and nonfat dry milk from processors. These purchases help maintain market prices at the legislated support level. The CCC liquidates these commodities by either selling or swapping in the private sector or by donating to foreign or domestic feeding programs.

The Non-Insured Crop Disaster Assistance Program provides assistance to growers of crops for which federal crop insurance is not available. Payments are made to eligible producers when the

expected area yield is less than 65 percent of normal and individual crop losses are in excess of 50 percent of the average yield. Payments are made on losses above 50 percent at 60 percent of the expected market price. To be eligible for this program, a farmer must report acres and yields to the FSA by the yearly deadline.

The FSA offers direct and guaranteed farm ownership and operating loan programs to farmers who are temporarily unable to obtain private, commercial credit. Under the guaranteed loan program, the FSA guarantees loans made by conventional agricultural lenders for up to 95 percent of principal. For those unable to qualify for a guaranteed loan, the FSA also lends directly. Direct loans are made and serviced by FSA officials, who also provide borrowers with supervision and credit counseling.

16.3.11 Cooperative State Research, Education and Extension Service

This agency is assigned responsibility for all cooperative research programs previously performed by the Cooperative State Research Service. It is also assigned all cooperative education and extension programs presently under the Extension Service. This agency provides information and education.

The NRCS also coordinates the Colorado River Salinity Program to reduce salt loading from poor irrigation practices in the Duchesne/Strawberry and Ashley/Brush units.

16.3.12 Rural Development

Rural Development is authorized to provide financial assistance for water and waste disposal facilities in rural areas and towns of up to 10,000 people. Priority will be given to public entities in areas smaller than 5,500 people. To be eligible for loan and grant funds, water or waste disposal systems must be consistent with state or subdivision development plans and rules. Rural Development also makes loans for resource conservation and development projects.

16.4 Federal Concerns

Federal agencies identified four concerns in the *1990 State Water Plan*. All apply to the Uintah Basin. These concerns were: 1) reserved water rights, 2) interrelated planning, 3) stream and riparian habitat loss, and 4) water right filings. The agencies have made progress on all these concerns.

One other concern that has been raised is the lack of coordination between federal, state, and local officials and the Ute Indian Tribe during planning and implementation of various programs. More can be done to promote better working relationships between local, state, Indian and federal jurisdictions. ❑

Content

Section 17
Uintah Basin Plan

Utah State Water Plan

Water Conservation

When Utah's pioneers had to draw water from a well or carry it from the creek, conservation and respect for the scarcity of water was a way of life.

17.1 Introduction

This section discusses conservation ideas and their significance to water planning. The need for water pricing strategy to provide stable revenues and provide incentives for water users to improve efficiency is also addressed as an important part of any conservation program.

Water conservation planning has been required by legislation recently passed by the state legislatures (HB 153). Water conservancy districts and water retailers must submit a water conservation plan if they serve more than 500 connections.

As this generation looks to the future from the perspectives of cultural traditions and strong economic growth, it has become aware of the need to conserve water. Water sources presently being developed are expensive. New sources will be even more costly. The time to think about and teach conservation has come. Fortunately, water development in the basin has kept ahead of water needs in modern times.

People can achieve significant water use reductions when they understand the reasons to conserve. Communities have shown a willingness to temporarily reduce water use during times of drought. Public education to teach the benefits of carrying out long-term water conservation programs will prepare people to support them as the need arises. A well-managed water conservation program may postpone the need for building new facilities and finding additional supplies.

Effective conservation programs combine measures designed to reduce the demand for water with measures to improve efficiency of delivery systems. Demand reduction measures include devices and practices employed by water users. It also includes pricing policies that discourage overuse and provide incentives for users to use their water more efficiently.

17.2 Background

The Colorado River Salinity Control Program has provided incentives for converting to sprinkler irrigation. Under this program, farmers and ranchers have increased the amount of land under sprinkler irrigation to become more efficient and to increase profits.

City councils and district boards help determine whether their citizens have incentives to use water efficiently by the way water prices are set. Table 17-1 shows the water rates (prices) for selected communities.

The selected communities follow a common practice of pricing water with a substantial base charge, a base allocation of 8-12,000 gallons, and a flat fee for all water used in excess of the base allocation.

Of the communities shown, Manila, Tridell and Duchesne residents have the least monetary incentive to use water efficiently. The remaining communities have more incentive to be efficient because wasted water carries a significantly higher price. But all of the systems should make major changes in their overage charge to encourage water conservation.

17.3 Water Conservation Opportunities

While much has been done to increase efficiency of water use, there are opportunities to do

Table 17-1
Uintah Basin
Water Rates For Selected Communities

City/Town	Base Charge ($)	Base Allocation (gallons)	First Overage to 20,000 ($/1,000 gallons)	Second Overage 20,000+ ($/1,000 gallons)
Duchesne	19.50	10,000	.85	.85
East Duchesne	35.00	10,000	1.00	1.00
Fruitland	30.00	10,000	2.00	2.00
Maeser	13.00	10,000	1.30	1.30
Manila	20.00	12,000	.22	0.22
Neola	21.50	8,000	1.19	1.19
Roosevelt	17.00	10,000	1.19	1.19
Tridell	15.00	10,000	.50	.50
Vernal	12.00	10,000	1.10	0.90

more. Inefficiencies can be found in several areas of water use.

17.3.1 Agricultural

Opportunities still exist to improve the conservation of water used for irrigation. Canals can be combined, piped or lined and those farming who are still flood irrigating can be encouraged to convert to sprinkler irrigation.

The Colorado River Salinity Control Program has assisted farmers and ranchers in purchasing sprinkler systems that conserve water and minimize the amount of soil-leached salt that eventually ends up in the Colorado River System.

17.3.2 Residential

Opportunities abound for residential water conservation. Appliances that use water efficiently, such as low-flow toilets and showers, could be installed. A water-wise landscaping design using drought-tolerant plants, rock or hardscaping (patio) could be used to replace or reduce large lawns or open areas. More efficient use of water for landscaping, such as frequency of watering and limiting watering during midday (10:00 a.m. to 6:00 p.m.), could be practiced.

17.3.3 Municipal

Municipal water could be conserved by metering and charging for water delivered to parks, schools, golf courses and cemeteries. Computer monitoring and control systems are also available which can shut down a part of a system where malfunctions occur and send a warning to a central control facility. Several of these systems are now in operation in Utah. Leak detection programs may enable municipalities to reduce water lost. Many opportunities exist to conserve treated culinary water by substituting low quality water for irrigating lawns and gardens.

Low water-using plants are available to beautify landscapes in a municipal setting. When combined with state-of-the-art irrigation management systems and incentive pricing schedules, significant water savings can result.

17.3.4 Commercial

Opportunities for conserving water at commercial facilities are also available, but economic feasibility is questionable in some cases.

17.3.5 Industrial

Water is metered to all industries that are on public municipal systems. Opportunities exist for conserving water through the price structure for those on metered public systems. Water conservation may not be an issue for those industries on self-supplied systems. Recycling, such as from power plant cooling towers, and process modifications can be a good water conservation alternative.

17.3.6 Wastewater Reuse

Effluent from wastewater treatment plants may be used for many applications such as lawn and garden irrigation, golf course watering and agricultural. Additional treatment (tertiary) may be required. Roosevelt is already using reclaimed water for lawn application on its golf course.

Wildflowers in the Uintah Basin

17.3.7 Methods and Strategies

Water conservation objectives can be achieved by regulation or by incentives. An example of such regulation is the state law which mandates all new construction will have low-flow appliances and fixtures.

Incentive programs include water pricing schedules that increase the unit costs as water use goes up. Public and private water providers should compare the cost of developing new sources with the cost of purchasing and installing low-flow fixtures for their customers. The Water Conservation Credit Program contained in the Central Utah Project Completion Act is a combination of regulation and incentive programs.

Conjunctive use of water supplies, also called "joint use," is a strategy where use of surface water is coordinated with use of groundwater. Where both water sources are available, groundwater can be allowed to accumulate during wet years and then be pumped in dry years to supplement surface water supplies. This is an excellent example of wise use because it manages the total water supply, thus maximizing system efficiency.

17.3.8 Conservation Impacts

Conservation impacts have not been modeled for the Uintah Basin. Based on modeling done in other areas, installing efficient plumbing fixtures reduces water use by about 8 percent.

17.4 Central Utah Project Water Conservation Credit Program

The Central Utah Project Completion Act provides strong incentives for water conservation. Objectives of the conservation incentives include increasing efficiency in water use and to provide instream flows for fish and wildlife.

Water management improvement studies discussed in Section 9 include a Water Conservation Credit Program as part of the Central Utah Project. The purpose of the credit program is to identify, evaluate, prioritize and implement water conservation projects included in the *Water Management Improvement Plan*. The goal of the program is to conserve 49,622 acre-feet of water annually. Up to 65 percent of costs for each project placed on the active inventory may qualify for federal grants. The remaining 35 percent must come from local or state funds. Congress authorized $50 million in federal funds for this program. The Central Utah Water Conservancy District will annually evaluate the effectiveness of the credit program and may adjust any section as necessary. Project requirements and evaluations will not differ between proposed projects in any given period when two or more projects are being compared.

Any person, group or organization with an idea for a project that conserves water is eligible to participate in the Water Conservation Credit Program. Not all projects submitted will be selected for funding and implementation. All projects must complete all elements listed in the Water Conservation Credit Program document dated July 1993. A copy may be obtained from the Central Utah Water Conservancy District.

17.5 Public Education

Water education provides an excellent approach to help children learn how to be responsible citizens in terms of water issues. As they learn about water, they gain a respect for this resource that will become more and more important as water-related issues become prominent. Informed citizens would be better able to make decisions regarding water issues. The purpose of the Division of Water Resources Water Education Program is to educate students in grades K-12 about water. The children, in turn, learn to make decisions based on a knowledge of water and its origins.

Water education is achieved through various means. The Division of Water Resources is the custodian of the international water education program called Project WET (Water Education for Teachers). Project WET workshops are held throughout the state in order to train educators to use the collection of 90 innovative, interdisciplinary activities. Teachers are generally enthusiastic about teaching various aspects of water, and Project WET is a good tool for them to use. The program fits into a wide range of curricula from science to social studies.

The annual Young Artists Water Education Poster Contest is an event which continues to be the highlight of October, which is Water Education Month. Children in grades K-6 participate in this statewide contest each year. Themes chosen each year all relate to water as a resource.

17.6 Issues and Recommendations

There is growth in some areas which makes conservation an important component of the plans for meeting future needs. Three policy issues are discussed below.

17.6.1 Community Water Management and Conservation Plans

Issue - Every community should have plans for meeting future growth demands.

Discussion - Developing additional sources of water for residential use is costly due to restrictions on development. Conserving high quality water sources to serve portions of future growth will be increasingly competitive with the development of new supplies. State legislation (HB 153) changed the 1999 Act to exempt all water retailers with less than 500 connections. It also requires water conservation plans to be updated every five years.

The 1997 Water Conservation Plan Act requires all conservancy districts and water retailers serving more than 500 connections to prepare water conservation plans.

Water suppliers need to identify conservation goals in relation to supplies and demands. Alternatives to provide water to meet projected demands should be identified. The Division of Water Resources has recently completed an inventory of present supplies and system capacities and has estimated projected demands. Refer to Section 11 for data on these items. This can be the basis for preparing a water conservation plan for each community. Guidelines for preparing water conservation plans can be obtained from the Division of Water Resources.

Recommendation - Water management and conservation plans should be developed by all cities and towns.

17.6.2 Water Conservation Landscaping and Irrigation

Issue - The use of water-conserving landscapes can reduce water use.

Discussion - Landscapes use a major portion of the culinary water in most communities. Extensive turf, such as in yards, school grounds, park and golf courses has become the normal landscaping practice. Research reveals that most of these turf areas are over watered, wasting up to 50 percent of the water applied. More efficient irrigation and reduced turf acreages can conserve water and still maintain appealing, attractive landscapes

Water efficient landscaping uses a combination of native plants, low water-using exotic or imported plants, mulched flower beds, hardscaping (decks, patios and rock gardens), and smaller selective turf areas to achieve a pleasing mix. Correctly designed landscaping can also meet the needs for family recreation and entertainment areas along with beautification. A list of low water-using plants applicable to the Uinta Basin can be obtained from nurseries and landscape designers in the area. In addition, the Division of Water Resources and Utah Extension Service have similar information.

New residential construction lends itself best to low water-using landscapes. Installation is more expensive than the current typical landscaping, but it will achieve an aesthetic, functional design. Installation costs can be recaptured through more economical operation and maintenance outlays. Replacing existing landscaping can be very costly; however, it does provide an opportunity to redecorate the outside areas while conserving water. Feasibility will depend on the cost of water and individual desires. Tax incentives can also be used to encourage use of low water using landscapes.

Recommendation - Communities, especially Roosevelt, Vernal and Duchesne, should conduct water audits on large turf areas and install water conserving landscape demonstration projects on city property and consider adopting a landscape ordinance.

17.6.3 Water Pricing

Issue - Water rate schedules can affect water use.

A pricing strategy may be among the most powerful conservation tools at a water utility's disposal. Cities and water districts are finding certain rate schedules can help modify customer behavior and meet conservation goals. Organizations responsible for maintenance of large areas of turf should be billed for the cost of water, even if it is the municipality. This would bring about recognition of the cost of water.

Conservation rate schedules should have the following characteristics:

Equity - Each customer group will be treated the same, or must feel they are doing no more or less than any other customer group. Each customer group may be assigned a goal which defines the upper limit of efficient water use. For residential customers, the goal is based on the number of people per household and landscape water needs.

Revenue Stability - This will avoid the decrease in revenue that traditionally accompanies conservation actions by customers. To avoid the rise and fall of revenues directly linked to water sales, 100 percent of fixed cost of a water system may be recovered with a monthly service charge. Charges for water used as a commodity are calculated separately. These will cover variable costs of deliveries, such as pumping and treatment chemicals. With all fixed costs covered by the service fee, revenues during droughts and periods of wet weather are adequate.

Credibility - The rate structure should be based on defensible information that is logical, simple and credible in the eyes of the customers. Success of any rate structure rests on the perception by customers that the system is fair and based on scientific principles. Credibility is also gained by providing customers data on water needs based on lot size, continuous customer education about the rates, incentives, penalties, and the need for water efficiency.

Building a Conservation Ethic - Utah's water supply and growth analysis by the Division of Water Resources shows conservation must be practiced now to delay expensive new water investments in the short term and chronic shortages in the future. Setting customer goals and providing pricing incentives that convey a clear conservation message builds a water efficiency ethic among customers. Through continuing education, customers generally understand that wasted water is expensive water. A rate structure with steep price increases above a base rate sets a price on inefficient water use. The combination of an equitable, logical and credible rate structure with price incentives to achieve goals, starts the process of building a long-term water conservation ethic.

Focusing efforts on helping culinary water users achieve low water bills along with keeping rates as low as possible addresses the most fundamental issue in the minds of customers. While introduction of a conservation rate structure may increase phone calls and visits from customers, it increases the opportunity for culinary water providers to impact customers in a positive way. Customer calls can provide valuable information for correcting account information on number of people served and landscaped area. This also provides opportunities for explaining how the customer can improve landscape watering or indoor water use practices.

The conservation impact of a well thought out conservation rate structure by public water suppliers may save up to 15 percent for residential users and up to 45 percent for landscape irrigation. Rate structures that penalize high water use with

increased rates may generate excess revenues for funding other conservation programs. This occurs because a 10 percent increase in price will cause a decrease in use of something less than 10 percent.

Under the Central Utah Project Completion Act, the Central Utah Water Conservancy District completed a study of wholesale and retail pricing to encourage water conservation. This study is contained in the *Report on Water Pricing Policy Study -- 1995*. It focused on ways to conserve water by reducing demand via various pricing mechanisms.

The study examined policies for irrigation water pricing, wastewater pricing, wholesale and retail culinary water pricing, and conservation pricing. The experiences of other water-constrained communities were also examined. The rate structures evaluated include uniform rates, seasonal rates, drought year surcharges, increasing block rates, ratchet rates, marginal cost pricing and goal-based rates. The study pointed out that changes in pricing policies are likely to gain greater public acceptance if they are phased in over time.

Recommendation - Local water providers should adopt water rate schedules that encourage water conservation. ❑

Content

Section 18
Uintah Basin Plan

Utah State Water Plan

Industrial Water

Although the use of water by industry in the basin is small, it serves many uses and carries a high value. Water is used industrially to generate power, as a solvent, for temperature control, for cleaning, to transport mining ore and concentrate, to convey sanitary wastes, and for aesthetics.

18.1 Introduction

This section discusses the present and future uses of water for industrial purposes in the Uintah Basin. For this report, industrial water use is defined as water used in mining and manufacturing operations, including the production of oil, gas, chemicals, fertilizer or any other product. It includes power production, processing, washing, mineral slurrying, oil well water-flooding and cooling operations, as well as employee use. Also included, to the extent they can be identified, are such activities as gravel washing and ready-mix concrete production.

18.2 Background

Major industrial uses of water are for potash mining operations at the fertilizer quarries and gilsonite mines, and also for power production at the Desert Generation & Transmission Power Plant. Water-flooding is also being used for injection wells in the oil fields. Because it is part of a patented mining process, the actual amount of water used is considered confidential information. This is typical of many industrial water uses.

18.3 Current and Projected Industrial Water Use

No single agency or entity promotes and monitors the development or use of industrial water, although its use must conform to existing state laws for water rights, pollution control, and other state rules and federal regulations. The State Engineer's Office has surveyed and published statewide industrial water-use data for several years. Although the State Engineer's Office will not divulge the quantity of water used by individual industrial water users, the office has reported the collective 1996 total industrial water use in the Uintah Basin from privately held water rights as 11,830 acre-feet. The 1996 data on privately held industrial water rights is shown in Table 18-1. The majority of the privately developed industrial water comes from wells, with only 1,020 acre-feet coming from surface water and springs. In addition to the privately held water rights used for industrial purposes, many industries use water purchased from wholesale suppliers.

Oil refinery in the Uintah Basin

Table 18-1
Self-Supplied Industrial Water Use

	Depletions (Acre-Feet/Year) 1996	2050
Privately Held Water Rights[a]		
Surface Water and Springs	1,020	1,020
Wells	10,810	22,680
TOTAL	11,830	23,700

[a]Water use data provided by the Utah Division of Water Rights.

Water planners and managers need to provide for the future construction of treatment and distribution facilities to accommodate an expected increase in industrial water demand. In contrast to residential and commercial water uses which grow somewhat uniformly with population, future industrial use is difficult to predict. Future enlargement of Desert Generation and Transmission Power Plant and phosphate operations could increase depletions to 23,700 acre-feet by the year 2050.

18.3.1 Oil and Gas Well Production[116,99]

About 2,280 oil wells and 1,270 gas wells presently exist in the Uintah Basin. More than 300 wells will be drilled within the Monument Butte Oil Field between 1997 and 2050. About 500 wells are in production. Based on a 40-acre spacing pattern, about 50 percent will be injection wells. Water obtained from other wells and surface water will be injected into the oil and gas bearing zones to force more oil and gas to the surface. The water-flooding would increase ultimate oil recovery by about 350 percent. This secondary recovery method could yield approximately 18 million barrels of oil in the Monument Butte Oil Field.

The Chevron Greater Red Wash Oil Field has been using water-flooding since 1982. Water is injected into the injection wells to a depth of 5,200 feet until the original pressure of the oil reservoir is reestablished. Oil recovery rates increase until the water has pushed the oil and gas to the producing wells. After water reaches the production well, some water is forced to the surface with the crude. The water will be separated from the oil and gas and re-injected into the oil field. Once the oil field has been repressurized, only the oil, gas and water pumped from the well will need to be replaced. The life of the oil field can be increased by 10 to 15 years. The U. S. Fish and Wildlife Service (FWS) is currently reviewing a Bureau of Land Management Environmental Assessment for oil and gas production in the Uintah Basin. The cumulative impacts section states that approximately 4,213 new wells will be drilled in the next 10-15 years. The FWS is concerned about potential impacts of underground injection on the endangered Colorado River fishes.

The underground injection of water is monitored by the Utah Division of Oil, Gas and Mining.

18.3.2 Mineral Mining and Processing

Gilsonite companies mine about 60,000 tons of gilsonite annually in the basin. Gilsonite is used in car batteries, paints, varnishes, anti-corrosive coatings, insulating and water-proofing jackets for underground pipes and automotive sealers. More recently, gilsonite has been used in the manufacture of metallurgical-grade carbon coke and high-purity carbon electrodes for the nuclear power industry. Water is used in dust control and processing of the gilsonite.

Tar sands and oil shale are also prevalent in the Uintah Basin. The Division of Water Resources designed the White River Dam Project to furnish water for the oil shale boom. The project projected a 75,000 acre-feet depletion of water resources in the final Environmental Impact Statement by the Bureau of Land Management. The dam was never built due to a reduction in the price of oil on the world market and the increased cost to recover oil from oil shale.

Phosphate rock is mined at the S. F. Phosphates Limited Company quarry near Vernal. The Vernal mine and mill are currently capable of producing about 1.3 million tons of phosphate concentrate per year. The original plant was constructed in 1960. A new expansion of the Vernal and Rock Springs plants will increase their production by 26 percent.

Table 18-2
Hydroelectric and Coal-Fired Power Plants

Name	River	Capacity[a]	Owner
DG&T[b]	White River	450,000 kw	Desert Generation & Transmission Co-Op
Sand Wash	Lake Fork River	2,000 kw	Mistletoe Finance Company
Yellowstone	Yellowstone River	900 kw	Moon Lake
Uinta	Uinta River	1,200 kw	Moon Lake
Flaming Gorge	Green River	145,850 kw	Bureau of Reclamation

[a]Department of Natural Resources, Office of Energy and Resource Planning, *A Survey of Small Hydroelectric Potential at Existing Sites in Utah,* 1980.
[b]Coal-fired.

Construction started during the summer of 1998, with completion planned for January 2000. A 96-mile pipeline transports the phosphate slurry to a fertilizer plant in Rock Springs, Wyoming. Four on-site wells and two springs provide the water for the ore processing and slurry pipeline. The system has total containment with no water being released to Brush Creek.

18.3.3 Hydroelectric and Coal-Fired Power Plants

Hydroelectric power plants generate power by the use of pressure head either from the height of the dam or a pipeline from a canyon of higher elevation. The basin has four hydroelectric power plants. Flaming Gorge is the largest, with a capacity of 145,850 kilowatts. The Sand Wash Hydro, Yellowstone River and Uinta River plants are smaller, with a total capacity of 4,100 kilowatts. These hydroelectric power plants do not deplete water from the system.

Deseret Generation & Transmission Cooperative (DG&T) is a utility serving six rural electric distribution cooperatives in Utah and four adjacent states. The systems serve about 30,000 consumers. The plant burns about 200 tons of coal per hour and produces about 450,000 kilowatts of power. Coal is shipped from Rangely, Colorado, on a DG&T electric rail system. Water for cooling and processing is transported by pipe from wells along the Green River in the Jensen area to the DG&T plant. The waste effluent from the cooling towers is piped to lined evaporation lagoons. All water is evaporated, either during the cooling process or in the lagoons. Hydroelectric and coal-fired power plants are shown in Table 18-2. ❑

Content

Section 19
Uintah Basin Plan

Utah State Water Plan

Groundwater

Groundwater is a source of water for municipal, industrial and agricultural uses in the Uintah Basin.

19.1 Introduction

Groundwater occurs in underground aquifers that are hidden from view. The boundaries of an aquifer are physical, thus they may outcrop, i.e., be offset by faulting against an impermeable rock unit. Aquifers may grade laterally into a lower permeability deposit due to changes in the depositional environment, or they may thin and disappear. At any given location, the land surface may be underlain by several aquifers. Each aquifer may have different chemical quality and different hydraulic potential. Each aquifer may be recharged in a different location and may flow in a different direction. Groundwater divides do not necessarily coincide with surface water divides. These unique conditions demonstrate that the development and management of groundwater is more complicated than that of surface water.

Groundwater in the Uintah Basin has been developed for use as public water supplies, irrigation water and stock watering. Springs were the first method developed to access underground water, followed by wells.

19.2 Aquifer Characteristics

Unconsolidated, valley-fill materials have traditionally been the best producers of groundwater in Utah. About 98 percent of the wells in Utah are completed in unconsolidated deposits. In the Uintah Basin, however, the occurrence of unconsolidated deposits is limited. The unconsolidated deposits, where present, are composed of alluvium, colluvium and glacial deposits of morainal and outwash origin. The most extensive unconsolidated aquifers are found in the Duchesne-Myton-Pleasant Valley area[76] and the plain east of Neola.[51] In most other areas, the unconsolidated aquifers are found in the bottoms of mountain canyons, in stream valleys and as discontinuous caps on terraces. These deposits are rarely more than 50 to 70 feet thick. Wells and springs in these deposits are found to yield from small to very large amounts -- less than 10 to greater than 1,000 gpm -- but few wells yield more than 1 cfs.[76,51]

Due to the lack of unconsolidated aquifers in much of this basin, the only other groundwater source that can be developed is from consolidated or bedrock aquifers. While all geologic formations contain some water, those in the Uintah Basin which have been identified as being the best groundwater targets are the Browns Park, Duchesne River, Uinta, Current Creek and Morgan formations, Nugget/Navajo sandstone and Weber quartzite. These consolidated aquifers are considered the best for development.

Groundwater in these consolidated formations is unconfined in locations nearest areas of recharge. Confined conditions, however, are the most common and occur in about 90 percent of the area within the basin underlain by sedimentary rocks.[55]

The circulation of groundwater in these consolidated aquifers is affected by folding and faulting, which locally will either enhance groundwater movement by fracturing or impair groundwater movement by offsetting aquifers. Local fracturing also enhances interformational leakage, which affects water quality.

19.3 Groundwater Budget

Aquifers lose water from storage, referred to as discharge, through evapotranspiration, discharge at springs and seeps, subsurface outflow, and through well production. Aquifers receive additional water, referred to as recharge, through infiltration of surface water in the form of rain, snow melt, and/or streamflow and irrigation in recharge areas and by subsurface inflow. The downward percolation of water from these sources into and through bedrock layers replenishes the aquifers.

Previous studies have shown that an average annual groundwater budget, including all sources of recharge and discharge to and from the aquifers of the Uintah Basin, have been about 630,000 acre-feet. The groundwater budget is summarized in Table 19-1.

19.3.1 Precipitation

The Uintah Basin aquifers, consolidated and unconsolidated, rely in large part on precipitation for their recharge. The majority of this basin receives less than 16 inches of precipitation per year (see Figure 3-4). Only the higher elevations in the western and northern areas of the basin, i.e., the Uinta Mountains and the area around Strawberry Reservoir, receive upwards of 20 to 40 inches of annual precipitation. Limited precipitation, particularly in the areas of outcropping aquifer host rock, results in limited infiltration and recharge.

The average annual volume of precipitation that fell on the hydrologic Uinta Basin (not including the north slope) during the period 1941-1970 is estimated to be about 8 million acre-feet. An estimated 600,000 acre-feet (7.8 percent of this total)[55,76] has infiltrated annually to recharge the groundwater aquifers.

19.3.2 Recharge and Discharge

Recharge to the consolidated bedrock aquifers is by several methods. Among them are the infiltration of precipitation directly into the fractured bedrock outcrops or into the aquifer from overlying, saturated unconsolidated deposits; the upward leakage of groundwater from underlying formations; the downward leakage of groundwater from overlying formations; the seepage into the aquifers from streams flowing across outcrops, where the water table is lower than the streambed, and by infiltration of irrigation water; and the recharge which occurs from the inflow of groundwater that originates outside the area but flows into the basin.

Recharge to the unconfined alluvial aquifer is supplemented by irrigation and return flow. Evidence that this occurs, at least locally, is the observation that the water level in alluvial wells responds to the application of water during the irrigation season.

Discharge of groundwater from the consolidated bedrock aquifers occurs at springs and seeps, including seepage into streambeds, through wells, by evapotranspiration, by upward leakage into the overlying formations and by downward leakage into underlying formations. Small groundwater flows also leave the basin by subsurface flow into neighboring basins.

The total annual estimated recharge of 630,000 acre-feet is divided between infiltration of precipitation which accounts for about 600,000 acre-feet per year of the total recharge and infiltration of irrigation water which adds about 20,000 acre-feet per year, while return flow from wells and springs accounts for the remaining 10,000 acre-feet per year. It has been observed that about 80 percent of the total recharge takes place in the northern half of the Uintah Basin. This is primarily due to the fact that more water, particularly in the form of precipitation, is available to enhance the recharge in the Uinta Mountains than is available to the much lower upland areas at the southern edge of the basin.

The total annual estimated discharge of 630,000 acre-feet is divided between evapotranspiration in phreatophyte areas which accounts for 246,000 acre-feet, seepage to streams and discharge to springs which combined accounts for 363,000 acre-feet, and well withdrawal which is estimated to account for the remaining 21,000 acre-feet. Subsurface inflow and outflow in the Uintah Basin is considered to be negligible.

19.3.3 Groundwater Storage

Based on previous studies, an estimated 31 million acre-feet of water is in storage in the basin's aquifers. This volume is only in the upper 100 feet

of saturated material and is figured without regard to water quality.

19.3.4 Springs and Wells

Figure 19-1 locates existing springs, and Figure 19-2 locates existing wells in the basin.

19.4 Water Quality

Groundwater in the Uintah Basin aquifers ranges from fresh (less than 500 milligrams per liter of dissolved solids) to briny (more than 35,000 milligrams per liter of dissolved solids). This is shown in Table 19-2. The freshest water is found in the Precambrian rocks of the Uinta Mountains. For each aquifer, the water is freshest in the recharge area. Then as it moves down gradient it becomes more saline as it dissolves soluble minerals. The total dissolved solids of the entire basin range between 25 mg/l in the Uinta Mountain Group and 178,200 mg/l found in the brines of the Green River Formation.[80] The overall chemistry of the groundwater changes as it moves from higher recharge areas toward the deeper central part of the basin. This trend is marked by the following changes. Initial water infiltrating in recharge areas is most commonly of the calcium-magnesium-bicarbonate type. As it begins its descent into deeper regions of the aquifer, it becomes a sodium bicarbonate type, then changes to a sodium sulfate, and finally becomes a type dominated by sodium chloride. This process, which is characteristic of most deep groundwater basins, is enhanced in the Uintah Basin by the presence in some formations of unusual salts. Among these are Nahcolite (sodium bicarbonate) and trona (hydrated sodium carbonate and sodium bicarbonate).[80,48]

19.5 Groundwater Management

The most easily developed and most productive source of groundwater for future needs is the glacial outwash and related coarse-grained unconsolidated deposits that underlie the flood plains of the Green, White and Duchesne rivers, the terraces and outwash plains (as near Neola), and the Ashley Valley area. Five major consolidated aquifers -- the Duchesne River, Uinta and Currant Creek formations, the Glen Canyon (Nugget) sandstone and the Weber quartzite -- are all relatively undeveloped, and withdrawals from them have not depleted storage. The Weber and the Glen Canyon formations are the most promising for large yields of fresh to slightly saline water.

19.5.1 Present Groundwater Use

Development of the groundwater resources in the Uintah Basin has been minor. This is due to several reasons: 1) The early development of surface water has been adequate for most needs; 2) the consolidated aquifers, generally, have hydraulic properties that preclude large-scale groundwater development; 3) the quality of the groundwater in some parts of the area is unsuitable for domestic, municipal and/or agricultural uses; and 4) the economics of drilling and pumping water from deeply buried aquifers is prohibitive.

The average annual discharge from wells for domestic and industrial use is 21,060 acre-feet, as shown in Table 19-3.

19.5.2 Groundwater Management Plan

A management plan, including data collection, groundwater modeling and analysis, is needed to facilitate development in areas where surface water is not available. Fruitland is one of these areas.

19.6 Problems and Alternatives

19.6.1 Selenium Contamination

The selenium problem at Stewart Lake Waterfowl Management Area, Lower Ashley Creek, Ouray National Wildlife Refuge and Pariette Wetlands should be resolved. At present, the Bureau of Reclamation and the USGS are studying the problem, and alternative solutions will be suggested. The problem is the groundwater flow into these areas.

19.6.2 Shallow Wells Drying Up

The more efficient use of canal lining and sprinkler systems has reduced the water lost to leaking canals and return flows. This reduction in groundwater has decreased or dried up shallow wells. Shallow wells are wells drilled to less than 100 feet deep. ❑

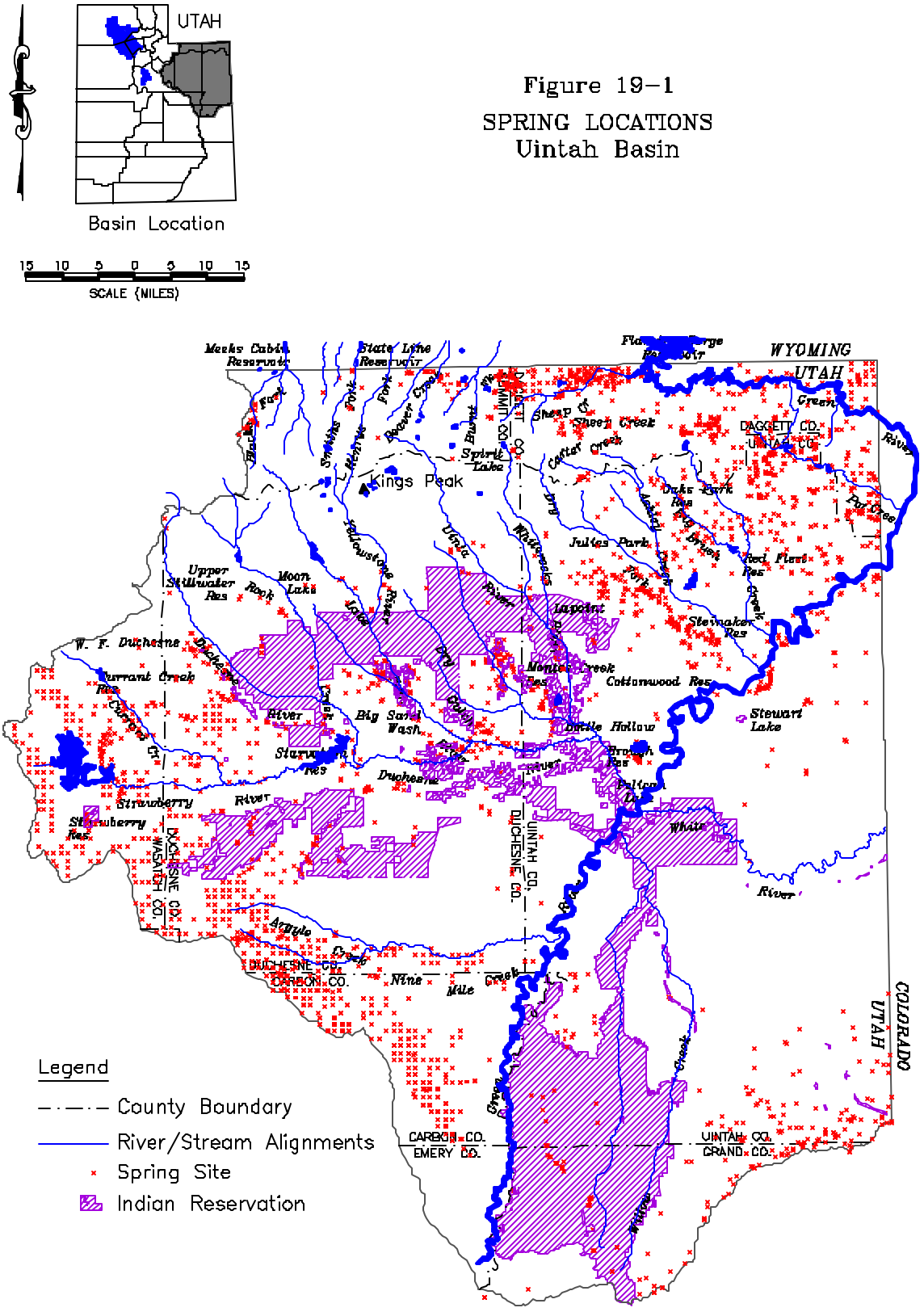


Figure 19–1
SPRING LOCATIONS
Uintah Basin

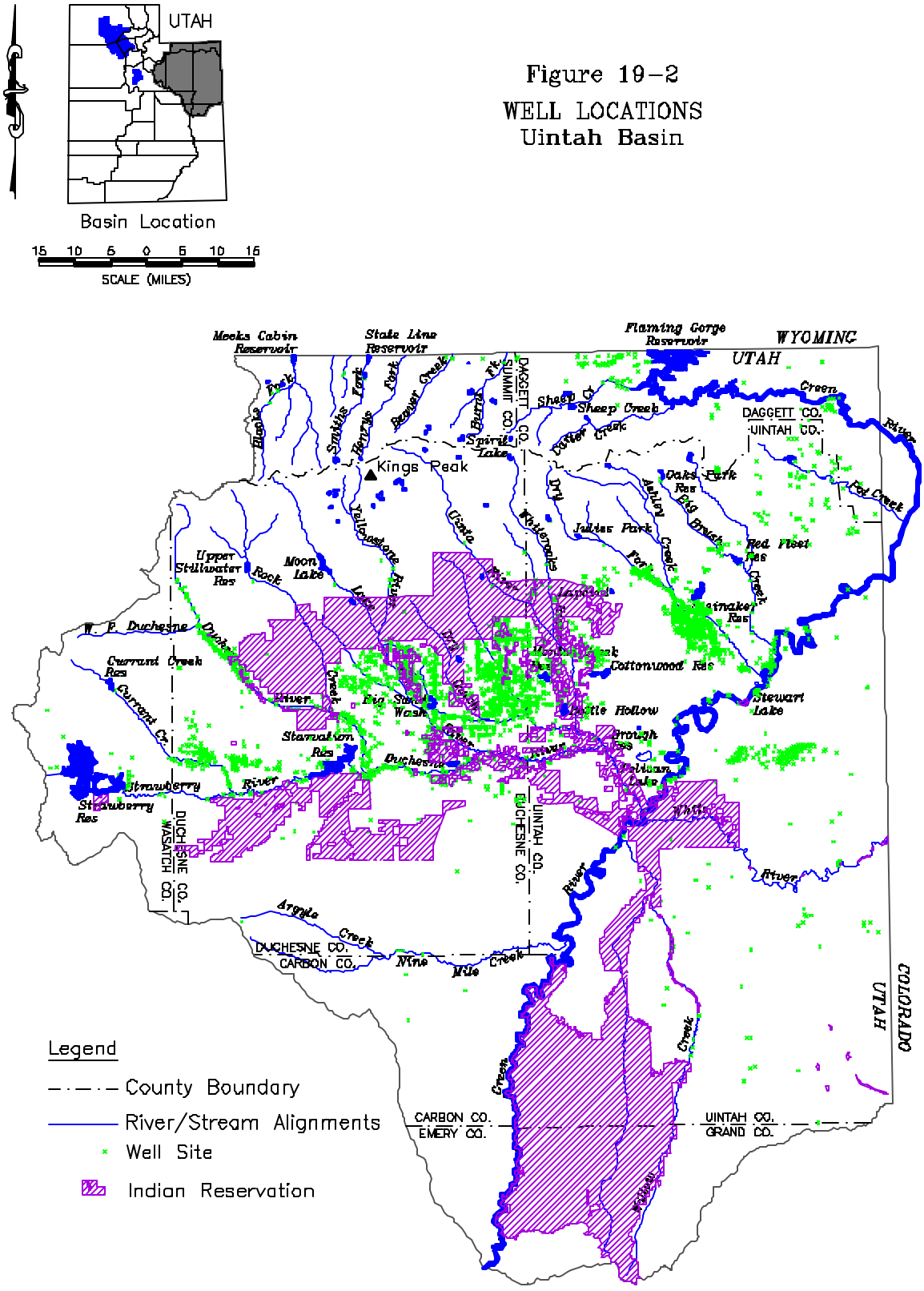


Figure 19-2
WELL LOCATIONS
Uintah Basin

Table 19-1
Groundwater Budget of the Uintah Basin

Component	Long-Term Average (ac-ft/year)
Recharge	
Precipitation	600,000
Irrigation Water	20,000
Return Flow from Well and Spring Discharge	10,000
Total	630,000
Discharge	
Streams and Springs	363,000
Evapotranspiration	246,000
Withdrawal from Wells and Springs	21,000
Total	630,000

Source: Holmes, W. F., *Water Budget and Ground-Water Occurrence in the Uintah Basin of Utah*, U. S. Geological Survey, in Utah Geological Association Guidebook.

Table 19-2
Total Dissolved Solids By Aquifer (mg/l)

Formation	High	Average	Low
Alluvium	29,900	2,900	260
Fluvialglacial	10,000	1,050	35
Browns Park	310	220	45
Duchesne River	30,800	1,170	85
Uinta	64,300	3,260	160
Currant Creek	640	335	170
Nugget/Navajo	1,870	430	160
Weber Quartzite	118,000	3,215	60
Morgan	185	180	180
Uinta Mountain Group	25	25	25

Source: Schlotthauer, W.E., *Identification and Characteristics of Aquifers in Utah*, Utah Div. of Water Rights, 1981.

Table 19-3
Withdrawals From Wells and Springs

Name	Discharge (ac-ft)
Municipal[a]	10,290
Mining Operations	3,000
Oil Production	770
Power Production	7,000[b]
Total	21,060

[a]Includes small industrial units and secondary water use.
[b]Alluvial wells by the Green River.

Acronyms, Abbreviations and Definitions

A.1 Acronyms and Abbreviations

Many names, titles, programs, organizations, legislative acts, measurements and activities are abbreviated to reduce the volume of words and to simplify communications. A few of the abbreviations and acronyms used in the Uintah Basin Plan are listed below.

A.1.1 State and Local Agencies and Organizations

CEM	Division of Comprehensive Emergency Management
CUWCD	Central Utah Water Conservancy District
DWQ	Division of Water Quality
DWRe	Division of Water Resources
DWRi	Division of Water Rights
DPR	Division of Parks and Recreation
DDW	Division of Drinking Water
DNR	Department of Natural Resources
DEQ	Department of Environmental Quality
GOPB	Governor's Office of Planning and Budget
MCD	Multi-County Planning District
SDCO	State Disaster Coordinating Office
SHMT	State Hazard Mitigation Team
UWQB	Utah Water Quality Board

A.1.2 Federal Agencies

BLM	Bureau of Land Management
BR	Bureau of Reclamation
COE(Corps)	Corps of Engineers
EPA	Environmental Protection Agency
FSA	Farm Service Agency
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FWS(USFWS)	Fish and Wildlife Service
GS(USGS)	Geological Survey
NRCS	Natural Resources Conservation Service
USDA	United States Department of Agriculture

A.1.3 Programs/Acts

ACP	Agricultural Conservation Program
CERCLA	Comprehensive Environmental Response and Comprehensive Liability Act

CRP	Conservation Reserve Program
CUP	Central Utah Project
CUPCA	Central Utah Project Completion Act
CWA	Clean Water Act
DWSPR	Drinking Water Source Protection Rule
ESA	Endangered Species Act
ECP	Emergency Conservation Program
NFIP	National Flood Insurance Program
NPDES	National Pollution Discharge Elimination System
RPDWS	Rules for Public Drinking Water Systems
SCORP	State Comprehensive Outdoor Recreation Plan
SDWA	Safe Drinking Water Act
UPDES	Utah Pollution Discharge Elimination System
USDWA	Utah Safe Drinking Water Act
UWPCA	Utah Water Pollution Control Act
UWQA	Utah Water Quality Act

A.1.4 Measurements

ac-ft	Acre-feet
cfs	Cubic Feet Per Second
gpcd	Gallons Per Capita Day
gpm	Gallons Per Minute
MCL	Maximum Contaminant Level
mgd	Million Gallons Per Day
mg/l	Milligrams Per Liter
mw	Megawatt
PMP	Probable Maximum Precipitation
SMCL	Secondary Maximum Contaminant Level
TDs	Total Dissolved Solids

A.1.5 Miscellaneous

EAP	Emergency Action Plan
EOP	Emergency Operations Plan
FIRE	Finance, Insurance and Real Estate
M&I	Municipal and Industrial
OHV	Off-Highway Vehicle
RC&D	Resource Conservation and Development
RIP	Recovery Implementation Program
RMP	Resource Management Plan
RPA	Reasonable and Prudent Alternative
TCPU	Transportation, Communications and Public Utilities
WCWEP	Wasatch County Water Efficiency Program
WWTP	Wastewater Treatment Plant

A.2 Water Resource Definitions

Many terms used in the water business have different meanings in different contexts and are sometimes confusing. Some words are used interchangeably. A few commonly used water terms are defined for use in this document.

A.2.1 Water Use Terms

Water is often said to be *used* when it is diverted, withdrawn, depleted, or consumed. But it is also *used* in place for such things as fish and wildlife habitat, recreation and hydropower production.

Commercial Use - Uses normally associated with small business operations which may include drinking water, food preparation, personal sanitation, facility cleaning/maintenance and irrigation of landscapes.

Consumptive Use - Consumption of water for residential, commercial, institutional, industrial, agricultural, power generation and recreational purposes. Naturally occurring vegetation and wildlife also consumptively use water. Water consumed is not available for other uses within the system.

Depletion - Net loss of water through consumption, export and other uses to a given area, river system or basin. The terms *consumptive use* and *depletion*, often used interchangeably, are not always the same.

Diversion/Withdrawal - Water diverted from supply sources such as streams, lakes, reservoirs, springs or wells for a variety of uses, including cropland irrigation and residential, commercial, institutional and industrial purposes. The terms *diversion* and *withdrawal* are often used interchangeably.

Industrial Use - Use associated with the manufacturing or assembly of products which may include the same basic uses as commercial business. The volume of water used by industrial businesses, however, can be considerably greater than water use by commercial businesses.

Institutional Use - Uses normally associated with general operation of various public agencies and institutions, including drinking water; personal sanitation; facility cleaning and maintenance; and irrigation of parks, cemeteries, playgrounds, recreational areas and other facilities.

Irrigation Use - Water diverted and applied to cropland. Residential lawn and garden uses are not included.

Municipal Use - This term is commonly used to include residential, commercial and institutional uses. It is sometimes used interchangeably with the term *public water use*.

Municipal and Industrial (M&I) Use - This term is used to include residential, commercial, institutional and industrial uses.

Private-Domestic Use - Includes water from private wells or springs for use in individual homes, usually in rural areas not accessible to public water supply systems.

Residential Use - Water used for residential cooking; drinking; washing clothes; miscellaneous cleaning; personal grooming and sanitation; irrigation of lawns, gardens, and landscapes; and washing automobiles, driveways and other outside facilities.

A.2.2 Water Supply Terms

Water is supplied by a variety of systems for many uses. Most water supply systems are owned by an irrigation company or a municipality, but in some cases the owner/operator is a private company or a state or federal agency. Thus, a public water supply may be either publicly or privately owned. Systems may also supply treated or untreated water.

Municipal and Industrial (M&I) Water Supply - A supply that provides culinary/secondary water for residential, commercial, institutional or industrial uses.

Public Water System (PWS) - A system providing water for human consumption and other domestic uses, which has at least 15 service connections or serves an average of at least 25 individuals daily at least 60 days out of the year and includes collection, treatment, storage or distribution facilities under the control of the operator and is used primarily in connection with the system, or collection, pretreatment or storage facilities used primarily in connection with the system but not under his control (see 19-4-102 of the Utah Code Annotated). All public water systems are further categorized into three different types: Community (CWS), nontransient noncommunity (NTNCWS) and transient noncommunity (TNCWS) areas.

Secondary/Nonpotable Water Supply - Pressurized or open-ditch water supplies of untreated water for irrigation of privately or publicly owned lawns, gardens, parks, cemeteries, golf courses and other open areas. These are sometimes called dual water systems.

Non-community Water System (NCWS) - A public water system that is not a community water system. There are two types of NCWSs: Transient and nontransient.

Non-transient Non-community Water System (NTNCWS) - A public water system regularly serving at least 25 of the same nonresidential persons per day for more than six months per year. Examples of such systems are those serving the same individuals (industrial workers, school children, church members) by means of a separate system.

Transient Non-community Water System (TNCWS) - A noncommunity public water system that does not serve 25 of the same nonresidential persons per day for more than six months per year. Examples of such systems are those serving a campground, RV park, diner or convenience store where the permanent nonresidential staff number less than 25, but the number of people served exceeds 25.

A.2.3 Groundwater Terms

Aquifer - A saturated body of subsurface rock or soil which will yield water to wells or springs.

Groundwater - Water which is contained in the saturated portions of soil or rock beneath the land surface. Excludes soil moisture which refers to water held by capillary action in the upper unsaturated zones of soil or rock.

Phreatophyte - A plant species that extends its roots to the saturated zone under shallow water table conditions and transpires groundwater. These plants are high water users and include such species as tamarisk, greasewood, willows and cattails.

Recharge - Water added to the groundwater reservoir, or the process of adding water to the groundwater reservoir.

Recoverable Reserves - The amount of water reasonably recoverable from the groundwater reservoir with existing technology.

Safe Yield - The amount of water withdrawable from an aquifer on a long-term basis without serious quality, environmental or social consequences, or without depletion of the aquifer's groundwater.

Total Water in Storage - A volume of water derived by estimating the total volume of saturated aquifer in intergranular space containing water (total volume multiplied by porosity).

A.2.4 Other Water Terms

The following water terms have special significance in the water industry:

Call - The ability to order a quantity or flow of water at a given time and for a given period of time from a water supplier.

Carriage Water - The water used in a sanitary waste transport system of toilets, sewers, etc. The water need not be of drinking water quality.

Drinking Water - Water used for a potable/culinary supply.

Export Water - A man-made diversion of water from a river system or basin other than by the natural outflow of streams, rivers and groundwater. This is sometimes called a *transbasin diversion*.

Instream Flow - Water flow maintained in a stream for the preservation and propagation of wildlife or aquatic habitat and for aesthetic values.

Nonpoint Source Pollution - Pollution discharged to lakes and streams over a wide land area, not from one specific location. This includes runoff of chemicals and fertilizer from agricultural land, animal waste runoff from feed lots, etc.

Point Source Pollution - Pollutants discharged from any identifiable point, including pipes, ditches, channels and containers.

Potable/Culinary - Water suitable for drinking or cooking purposes. The terms *culinary* and *potable* are often used interchangeably.

Reuse - The reclamation of water processed in a municipal or industrial wastewater treatment system.

Riparian Areas - Land areas adjacent to rivers, streams, springs, bogs, lakes and ponds. They are ecosystems composed of plant and animal species highly dependent on water.

Watershed - The total area of land above a given point on a waterway that contributes runoff water to the flow at that point; a drainage basin or a major subdivision of a drainage basin.

Wet/*Open Water Areas* - Includes lakes, ponds, reservoirs, streams, mud flats and other wet areas.

Wetlands - Areas where vegetation is associated with open water, wet and/or high water table conditions.

Water Yield - The runoff from precipitation that reaches water courses and, therefore, may be available for use.

Bibliography

1. Allen, D. V., R. B. Garrett, et. al., *Ground-Water Conditions in Utah*. Utah Division of Water Resources, Cooperative Investigations Report Number 34, 1994, 89 pages.

2. Aquacraft, Inc, *New Approaches in Assessing Water Conservation Effectiveness* in Conserve 96, Boulder, Colorado, January 1996.

3. Austin, Lloyd H., *Water Management Alternatives in the Uinta Basin*, Utah State University, Logan, Utah, 1970.

4. Austin, Lloyd H., and Gaylord V. Skogerboe, *Hydrologic Inventory of the Uintah Study Unit*, Utah State University, Logan, Utah, March 1970.

5. Barnes, Robert P., Mack G. Croft, *Ground Water Protection Strategy for the State of Utah*, Utah Department of Health, Salt Lake City, Utah, 1986.

6. Bear West Consulting Team, for the U. S. Department of Interior, Bureau of Reclamation, *Starvation Reservoir Resource Management Plan - Phase I Report*, Salt Lake City, Utah, April 1996.

7. Bear West, *Draft - Starvation Reservoir Resource Management Plan*, Salt Lake City, Utah, March 1997.

8. Bingham Engineering, for the Uintah Conservancy District, *Application to the U. S. Forest Service for Dry Fork/Ashley Creek Flood Control/Storage Project*, Salt Lake City, Utah, October 1988.

9. Blanch, George T., and Clyde E. Stewart, *Utilization of Irrigable Land in the Reservation Area of Uinta Basin, Utah*, Logan, Utah, March 1943.

10. Bolke, E. L., and K. M. Waddell, *Chemical Quality and Temperature of Water in Flaming Gorge Reservoir, Wyoming and Utah, and the Effect of the Reservoir on the Green River*, No. 2039-A, 1975.

11. Bolke, E. L., *Chemical and Physical Data for the Flaming Gorge Reservoir Area, Utah and Wyoming, 1973-75*, 1976.

12. Bolke, E. L., *Dissolved-Oxygen Depletion and Other Effects of Storing Water in Flaming Gorge Reservoir, Wyoming and Utah*, No. 2058, 1979.

13. Boyle, J. M., K. J. Covay, and D. P. Bauer, *Quantity and Quality of Streamflow in the White River Basin, Colorado and Utah*, No. 84-4022, 1984.

14. Bullock, Kenneth C., *Minerals and Mineral Localities of Utah*, Utah Geological and Mineral Survey Bulletin No. 117, Salt Lake City, Utah, January 1981.

15. Central Utah Water Conservancy District, *Basic Data for Bonneville Unit and District Facilities Operated and Maintained by the Central Utah Water Conservancy District*, Orem, Utah, August 1996.

16. Central Utah Water Conservancy District, *Preliminary Engineering Evaluation of Duchesne Valley Water Purification Plant and Myton Water Transmission Pipeline*, Orem, Utah, August 1985.

17. Central Utah Water Conservancy District, *Uintah Unit Replacement Project - Draft Environmental Impact Statement*, U. S. Department of the Interior (Joint-Lead Agency), American Fork, Utah, February 1997.

18. Central Utah Water Conservancy District, *Upalco Unit Replacement Project, Feasibility Study*, November 1996.

19. Central Utah Water Conservancy District, *Water Management Improvement Studies, Water Management Improvement Plan,* for the U. S. Secretary of the Interior and required under PL 102-575, Section 207(B)(5), Orem, Utah, August 1994.

20. Central Utah Water Conservancy District (lead agency), U. S. Department of the Interior (joint-lead agency), *Upalco Unit Replacement Project Draft Environmental Impact Statement,* American Fork, Utah, December 1996.

21. Central Utah Water Conservancy District, assisted by CH_2M Hill, Horrocks, and Carollo Project Team, *Upalco Unit Replacement Project Feasibility Study,* American Fork, Utah, November 1996.

22. CH_2M Hill for the Management Committee of the Recovery Implementation Program, *Duchesne River Hydrology and Water Availability Study*, Salt Lake City, Utah, October 1996.

23. CH_2M Hill and Horrocks Engineers, for the Central Utah Water Conservancy District, *Uintah Unit Potential Site - Specific Projects Summary Report*, Central Utah Project Completion Program, American Fork, Utah, January 1993.

24. CH_2M Hill and Horrocks Engineers, for the Central Utah Water Conservancy District, *Upalco Unit Potential Site, Specific Projects Summary Report - Uinta Basin Replacement Projects*, American Fork, Utah, January 1993.

25. CH_2M Hill and Horrocks Engineers, for the Cental Utah Water Conservancy District, *Uintah Unit Scoping Summary - Uintah Basin Replacement Projects*, Central Utah Project Completion Program, American Fork, Utah, March 1993.

26. CH_2M Hill and Horrocks Engineers, for the Central Utah Water Conservancy District, *Upalco Unit Scoping Summary - Uinta Basin Replacement Projects*, American Fork, Utah, March 1993.

27. CH_2M Hill and Horrocks Engineers, for the Cental Utah Water Conservancy District, *Task 19 - Summary Report to Evaluate Preliminary Project Alternatives - Uintah Basin Replacement Project*, American Fork, Utah, December 1993.

28. CH_2M Hill, Horrocks Engineers and Carollo Engineers, for Central Utah Water Conservancy District, *Uintah Unit Replacement Project Feasibility Study*, American Fork, Utah, January 1997.

29. Christensen, Bill, Water Commissioner, *Uintah and Lake Fork Rivers Sand Wash Creek*, Roosevelt, Utah, 1995.

30. Christensen, R. C., E. B. Johnson, and G. G. Plantz, *Manual for Estimating Selected Streamflow Characteristics of Natural-Flow Streams in the Colorado River Basin in Utah*, No. 85-4297, 1986.

31. Colorado River Salinity Control Basin, Uintah Basin Unit, Monitoring and Evaluating 1996 Report.

32. Conroy, L. S., and F. K. Fields, *Climatologic and Hydrologic Data, Southeastern Uinta Basin, Utah and Colorado, Water Years 1975 and 1976*, 1977.

33. Conroy, L. S., *Hydrologic and Climatologic Data, Southeastern Uinta Basin, Utah and Colorado, Water Year 1977*, 1979.

34. Conroy, L. S., *Hydrologic and Climatologic Data, Southeastern Uinta Basin, Utah and Colorado, Water Year l978*, 1980.

35. Daggett County, *Daggett County General Plan*, Manila, Utah, 1996.

36. Dinosaurland RC&D Council for the U. S. Department of Agriculture, Soil Conservation Service, *Dinosaurland Resource Conservation and Development Plan*, Salt Lake City, Utah, June 1980.

37. Donaldson, Walter K., for the Utah Division of Wildlife Resources, Fisheries Section, *Fish Management Evaluation on High Uinta Lakes, Lake Fork Drainage - Third Phase Survey*, Salt Lake City, Utah, 1981.

38. Duchesne County, *Duchesne County General Plan*, Duchesne, Utah, 1996.

39. Eychaner, J. H., *Estimating Runoff Volumes and Flood Hydrographs in the Colorado River Basin, Southern Utah*, No. 76-102, 1976.

40. Federal Water Pollution Control Act, *Public Law 92-500, 1972, as Amended.* Commonly called the Clean Water Act.

41. Feltis, R. D., *Water from Bedrock in the Colorado Plateau of Utah*, Technical Publication No. 15, 82 pages, 1966.

42. Fetter, C. W., *Applied Hydrogeology*, Merrill Publishing Company, 592 pages, 1988.

43. Freethey, G. W., and G. E. Cordy, *Geohydrology Of Mesozoic Rocks in the Upper Colorado River Basin in Arizona, Colorado, New Mexico, Utah and Wyoming, excluding the San Juan Basin*. U.S. Geological Survey Professional Paper 1411-C, 118 pages, 1991.

44. General Program and Alternatives Work Group of the Upper Colorado Region State-Federal Inter-Agency Group for the Pacific Southwest Inter-Agency Committee Water Resource Council, *Upper Colorado Region Comprehensive Framework Study, Appendix XVIII - General Program and Alternatives*, June 1971.

45. Goode, H. D., and R. D. Feltis, *Water Production from Oil Wells of the Uinta Basin, Uintah and Duchesne Counties, Utah*, 1962.

46. Hacking, Joseph B., Water Commissioner, *Ashley Creek Distribution System*, Vernal, Utah, 1995.

47. Hansen, Wallace R., *The Geologic Story of the Uinta Mountains*, Geological Survey Bulletin 1291.

48. Holmes, W. F., *Water Budget and Ground-water Occurrence in the Uinta Basin of Utah in Geology and Energy Resources, Uinta Basin of Utah*. Utah Geological Association Guidebook, p. 271-275, 1985.

49. Holmes, W. F., and B. A. Kimball, *Ground Water in the Southeastern Uinta Basin, Utah and Colorado*, No. 2248, 1987.

50. Holmes, W. F., *Results of Test Drilling for Ground Water in the Southeastern Uinta Basin, Utah and Colorado*, No. 80-951, 1980.

51. Hood, J. W., *Characteristics of Aquifers in the Northern Uinta Basin Area, Utah and Colorado*. Technical Publication No. 53, 71 pages, 1976.

52. Hood, J. W., J.C. Mundorff and Don Price, *Selected Hydrologic Data, Uinta Basin Area, Utah and Colorado*, 1976.

53. Hood, James, W., *Hydrologic Evaluation of the Upper Duchesne River Valley, Northern Uinta Basin Area, Utah*. Technical Publication No. 57, 34 pages, 1977.

54. Hood, J. W., *Hydrologic Evaluation of Ashley Valley, Northern Uinta Basin Area*, *Utah*, 1977.

55. Hood, J. W. and F. K. Fields, *Water Resources of the Northern Uinta Basin Area, Utah and Colorado, with Special Emphasis on Ground-Water Supply*. Technical Publication No. 62, 75 pages, 1978.

56. Horne, Merle H., for the Department of Natural Resources, Division of Water Resources, *Uinta Basin Study - Reconnaissance Level*, Salt Lake City, Utah, January 1973.

57. Horrocks and Associates, for the Central Utah Water Conservancy District, *West Central Uintah Basin Municipal and Industrial Water Study*, American Fork, Utah, January 1975.

58. Horrocks and CH_2M Hill, for the Central Utah Water Conservancy District, *Economic Analyses - Uintah Basin Replacement Project*, American Fork, Utah, June 1993.

59. Howells, Lewis, Mark S. Longson and Gilbert L. Hunt, *Base of Moderately Saline Ground Water in the Uinta Basin, Utah*, with an introductory section describing the methods used in determining its position. Technical Publication No. 92, U.S. Geological Survey Open-File Report 87-397, 59 pages, 1987.

60. Iorns, W. V., C. H. Hembree, D. A. Phoenix, and G. L. Oakland, *Basic Data on Chemical Quality of Water in the Lower Duchesne River Drainage Basin*, 64 p., 1959.

61. Kimball, B. A., *Geochemistry of Spring Water, Southeastern Uinta Basin, Utah and Colorado*, No. 2074, 1981.

62. Lewis, O. Grant, Paul W. Mielke, Jr., for Utah Department of Natural Resources, *An Assessment of Extra-Area Cloud Seeding Effects on the Uinta Mountains and Basin of Utah*, Colorado State University, Fort Collins, Colorado, November 30, 1990.

63. Lindskov, K. L., and B. A. Kimball, *Quality and Quantity of Streamflow in the Southeastern Uinta Basin, Utah and Colorado*, No. 2224, 1984.

64. Madison, R. J., *Water Quality Data for the Flaming Gorge Reservoir Area, Utah and Wyoming*, 1970.

65. Maxwell, J.D., B. L. Bridges, D. A. Barker, L. G. Moore, *Hydrogeology of the Eastern Portion of the South Slopes of the Uinta Mountains, Utah*. Utah Dept. of Natural Resources, Information Bulletin No. 21, 54 pages, 1971.

66. Mills, David W., *Water Allocation for Future Development in the Uintah Basin*, Utah State University, Logan, Utah, 1974.

67. Mountain Area Planners, *An Economic Profile of Daggett County with Employment and Population Projections, 1975, 1900 and 1990*, Salt Lake City, Utah, June 1972.

68. Mundorff, J. C., *Reconnaissance of Water Quality in the Duchesne River Basin and Some Adjacent Drainage Areas*, *Utah*, 1977.

69. Naten, R. W., and R. H. Fuller, *Selected Biological Characteristics of Streams in the Southeastern Uinta Basin, Utah and Colorado*, No. 81-644, 1981.

70. National Park Service, *Review Draft - General Management Plan Development Plans Land Protection Plan Environmental Assessment - Dinosaur National Monument*, Moffat County, Colorado, Uintah County, Utah, February 1986.

71. Nelson, W. B., and B. E. Lofgren, *Progress Report on Ground-water Investigations in Ashley Valley, Uintah County, Utah*, 6 p., 1950.

72. North American Weather Consultants, *Summary of Operations (1993 Water Year) and Evaluation of a Cloud Seeding Program in Northern Utah (Western Uinta Mountains*, NAWC Report No. WM93-11, Salt Lake City, Utah, October 1993.

73. Office of the State Climatologist, Utah State University, for Utah Division of Water Resources, *Precipitation Pattern Analysis, Uinta Basin - Wasatch Front*, Logan, Utah, Octoer 1990.

74. Palmer-Wilding Consulting Engineers, for Utah Division of Wildlife Resources, *Pot Creek Water Resources Investigation*, October 1981.

75. Palmer-Wilding Consulting Engineers, for Utah Division of Wildlife Resources, *Pot Creek Water Resources Investigation Addendum No. 1*, March 1982.

76. Price, Don, and Louise L. Miller, *Hydrologic Reconnaissance of the Southern Uinta Basin, Utah and Colorado*. Technical Publication No. 49, 66 pages, 1975.

77. Public Law 102-575, 102nd Congress, Titles III, *Central Utah Project Construction*, October 30, 1992.

78. Ritzma, Howard R., *Utah Geological and Mineralogical Survey*, Geologic Atlas of Utah, Daggett County, September 1959.

79. Safe Drinking Water Committee, *State of Utah Public Drinking Water Regulations, Part 1 - Administration Rules*, *Fifth Revision*, adopted February 1, 1986.

80. Schlotthauer, W. E., B. W. Nance and J. D. Olds, *Identification and Characteristics of Aquifers in Utah*. Utah Division of Water Rights, 240 pages, 1981.

81. Schroder, John F., *Landslides of Utah*, Utah Geological and Mineral Survey, College of Mines and Mineral Industries, University of Utah, Salt Lake City, Utah, September 1971.

82. Seiler, R. L., and J.E. Tooley, *Erosion and Sediment Characteristics of the Southeastern Uinta Basin, Utah and Colorado*, No. 82-428, 1982.

83. Steiger, J. I., and others, *Ground-Water Conditions in Utah*, Spring of 1996, page 2, 1996.

84. Stephens, D. W., and Bruce Waddell, *Non-point Source Selenium in the Uinta Basin, Utah* [abstract], in Proceedings of the Utah Non-Point Source Pollution Conference, Park City, Utah, September 20-21, 1990.

85. Stephens, D. W., and Bruce Waddell, *Selenium Sources and Effects on Wildlife Areas Along the Green River, Utah* [abstract], in Proceedings of the American Society of Limnology and Oceanography, Boulder, Colo., June 12-16, 1988.

86. Stephens, D. W., and Bruce Waddell, in Robarts, R.D., and Bothwell, M.L. (eds.), *Selenium Contamination of Waterfowl Areas in Utah and Options for Management*, *Aquatic Ecosystems in Semi-arid Regions: Implications for Resource Management: Saskatoon, Canada*, NHRI Symposium Series 7, p. 311.

87. Sumsion, C. T., *Water Resources Investigations in Dinosaur National Monument, Utah-Colorado, Fiscal Year 1970*, 52 p., 1971.

88. Sumsion, C. T., *Water Resources of Dinosaur National Monument, Utah and Colorado*, No. 76-580, 68 p.

89. Swasey, John A., Water Commissioner, *Duchesne and Strawberry River Distribution Report*, Duchesne, Utah, 1995.

90. Uintah Basin Soil Conservation District, *Environmental Assessment - Martin Lateral Watershed*, Duchesne and Uintah Counties, Utah, March 1980.

91. Uintah Basin Soil Conservation District, *Land Treatment Watershed Plan - Martin Lateral Watershed*, Duchesne and Uintah Counties, Utah, March 1980.

92. Uintah Basin Soil Conservation District, *Watershed Protection Plan and Environmental Assessment - Martin Lateral Watershed*, Duchesne and Uintah Counties, Utah, June 1981.

93. Uintah County, *Uintah County General Plan - County Policies, Objectives and Action Steps*, County Commission Review Draft, Vernal, Utah, 1996.

94. U. S. Army Corps of Engineers, *Red Fleet Dam and Reservoir, Big Brush Creek, Utah Water Control Manual - Draft Environmental Assessment*, Appendix IV to Master Water Control Manual, Upper Colorado River Basin, Sacramento, California, August 1995.

95. U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service, *Colorado River Salinity Control Program*, Washington, D.C., January 1987.

96. U. S. Department of Agriculture, Forest Service, Ashley National Forest, *Aquatic Ecosystem Inventory Macroinvertebrate Analysis - Annual Progress Report*, Provo, Utah, July 1994.

97. U. S. Department of Agriculture, Forest Service, *Ashley National Forest Map - Utah*, Salt Lake City, Utah, 1963.

98. U. S. Department of Agriculture, Forest Service, *Blanchett Park Dam and Reservoir - Draft Environmental Impact Statement*, Vernal, Utah, February 1995.

99. U. S. Department of Agriculture, Forest Service, *Draft Environmental Impact Statement - Western Uinta Basin Oil and Gas Leasing*, Uintah National and Ashley National Forests, Vernal, Utah, May 1996.

100. U. S. Department of Agriculture, Forest Service, *Final Environmental Impact Statement for Land and Resource Management of Ashley National Forest - Volume I*, Vernal, Utah, 1986.

101. U. S. Department of Agriculture, Forest Service, *Final Environmental Impact Statement for Land and Resource Management of Ashley National Forest - Volume II*, Vernal, Utah, 1986.

102. U. S. Department of Agriculture, Forest Service, *Final Environmental Impact Statement for the Blanchett Park Dam and Reservoir*, Uintah County, Vernal, Utah, January 1995.

103. U. S. Department of Agriculture, Forest Service, *Forest Plan for Land and Resource Management - Ashley National Forest*, Vernal, Utah, 1986.

104. U. S. Department of Agriculture, Forest Service, *Uinta National Forest Strawberry Valley Management Area Draft Environmental Impact Statement*, Provo, Utah, May 1990.

105. U. S. Department of Agriculture, Natural Resources Conservation Service, *Utah Annual Data Summary Water Year 1995*, Salt Lake City, Utah, 1995.

106. U. S. Department of Agriculture, Soil Conservation Service, *U.S.D.A. Salinity Report - Uintah Basin Unit, Utah*, Salt Lake City, Utah, November 1980.

107. U. S. Department of Agriculture, Soil Conservation Service, *Watershed Plan and Environmental Assessment for Sand Wash Watershed, Utah*, Salt Lake City, Utah, August 1987.

108. U. S. Department of Agriculture - Wasatch, Cache and Ashley National Forests, *Draft - Environmental Impact Statement, North Slope Oil and Gas Leasing*, Summit and Daggett Counties, Utah, Uintah County, Wyoming, February 1993.

109. U. S. Department of Interior, Bureau of Land Management, *Decision Record and Finding of No Significant Impact - Nine Mile Canyon*, Diamond Mountain Resource Area, Vernal, Utah, 1995.

110. U. S. Department of Interior, Bureau of Land Management, *Diamond Mountain Resource Management Plan - Planning Issues and Planning Criteria*, Vernal, Utah, September 1989.

111. U. S. Department of Interior, Bureau of Land Management, *Diamond Mountain Resource Management Plan Briefing Review*, Vernal, Utah, September 1990.

112. U. S. Department of Interior, Bureau of Land Management, *Draft - Diamond Mountain Resource Area Resource Management Plan and Enviornmental Impact Statement,* Vernal District Office, Vernal, Utah, November 1991.

113. U. S. Department of Interior, Bureau of Land Management, *Final Diamond Mountain Resource Area Resource Management Plan and Enviornmental Impact Statement - Volume I,* Vernal District Office, Vernal, Utah, 1993.

114. U. S. Department of Interior, Bureau of Land Management, *Final Diamond Mountain Resource Area Resource Management Plan and Enviornmental Impact Statement - Volume II,* Vernal District Office, Vernal, Utah, 1993.

115. U. S. Department of Interior, Bureau of Land Management, *Draft Environmental Impact Statement on the Book Cliffs Resource Management Plan*, Vernal, Utah, May 1984.

116. U. S. Department of Interior, Bureau of Land Management, *Draft Environmental Impact Statement on the Uintah Basin Synfuels Development*, Salt Lake City, Utah, August 1982.

117. U. S. Department of Interior, Bureau of Land Management, *Final White River Dam Project - Environmental Impact Statement*, Vernal, Utah, June 1982.

118. U. S. Department of Interior, Bureau of Land Management, *Northeastern Utah Map*, Salt Lake City, Utah.

119. U. S. Department of Interior, Bureau of Land Management, *Record of Decision and Rangeland Program Summary for the Book Cliffs Resource Management Plan*, Vernal, Utah, May 1985.

120. U. S. Department of Interior, Bureau of Reclamation, *Central Utah Regional Seismotectonic Study*, Denver, Colorado, March 1988.

121. U. S. Department of Interior, Bureau of Reclamation, *Colorado River Water Quality Improvement Program, Uintah Basin Unit Planning Report/Draft Environmental Impact Statement*, July 1986.

122. U. S. Department of Interior, Bureau of Reclamation, Duchesne River Area Study Committee, *Duchesne River Land and Water Resource Review - Bonneville Unit, Central Utah Project, Initial Phase*, Salt Lake City, Utah, April 1962.

123. U. S. Department of Interior, Bureau of Reclamation, *Middle Green River Remediation Planning Study, National Irrigation Water Quality Program*, Provo, Utah, July 1993.

124. U. S. Department of Interior, Bureau of Reclamation, *Uintah Unit Central Utah Project Feasibility Report*, Salt Lake City, Utah, May 1968.

125. U. S. Department of Interior, Bureau of Reclamation, *Uintah Unit Central Utah Project - Reevaluation Statement and Report for Certification of Physical, Economic and Financial Feasibility*, Salt Lake City, Utah, April 1975.

126. U. S. Department of Interior, Bureau of Reclamation, *Water Resources Uinta Resource Study*, Salt Lake City, Utah, July 1973.

127. U. S. Department of Interior, Bureau of Reclamation, *Uintah Unit Central Utah Project Status Report*, June 1980.

128. U. S. Department of Interior, Bureau of Reclamation, *Uintah Basin Unit Colorado River Water Quality Improvement Program*, July 1981.

129. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit Central Utah Project Definite Plan Report*, Salt Lake City, Utah, March 1980.

130. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit Central Utah Project - Final Environmental Statement*, Salt Lake City, Utah, March 1980.

131. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit, Central Utah Project, Supplement to Definite Plan Report*, Salt Lake City, Utah, May 1981.

132. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit Central Utah Project Definite Plan Report - Appendix A, Designs and Estimates Plan Formulation*, Salt Lake City, Utah, May 1981.

133. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit Central Utah Project Definite Plan Report - Appendix B, Water Supply*, Salt Lake City, Utah, May 1981.

134. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit Central Utah Project Definite Plan Report - Appendix C, Project Lands Agricultural Economy*, Salt Lake City, Utah, May 1981.

135. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit Central Utah Project Definite Plan Report - Appendix D, Financial and Economic Analysis Social Assessment*, Salt Lake City, Utah, May 1981.

136. U. S. Department of Interior, Bureau of Reclamation, *Upalco Unit Central Utah Project Definite Plan Report - Appendix E, Fish and Wildlife Resources*, Salt Lake City, Utah, May 1981.

137. U. S. Department of Interior, Bureau of Reclamation, *Ute Indian Unit Central Utah Project*, Salt Lake City, Utah, February 1968.

138. U. S. Department of Interior, Bureau of Reclamation, *Ute Indian Unit, Central Utah Project Concluding Report*, Salt Lake City, Utah, May 1980.

139. U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife, *Browns Park*, National Wildlife Refuge, Moffat County, Colorado.

140. U. S. Department of Interior, Geological Survey, *Geology and Fuel Resources of the Green River Formation Southeastern Uinta Basin, Utah and Colorado*, 548 pages.

141. U. S. Department of Interior, National Park Service, Rocky Mountain Region, *Statement for Management - Dinosaur National Monument*, Vernal, Utah, May 1990.

142. U. S. Geological Survey, in cooperation with the Utah Department of Natural Resources, *Hydrologic Reconnaissance of the Southern Uinta Basin, Utah and Colorado*, Technical Publication No. 49, 1975.

143. U. S. Geological Survey, for the Department of Natural Resources, Division of Water Resources, *Water Resources of the Northern Uinta Basin Area, Utah and Colorado, with Special Emphasis on Ground-Water Supply*, Technical Publication No. 62, Salt Lake City, Utah, 1978.

144. U. S. Geological Survey, in cooperation with the State of Utah, *Water Resources Data Water Year 1990*, Salt Lake City, Utah, 1994.

145. University of Utah Research Institute, Center for Remote Sensing and Cartography, *Land Use Inventory of Uinta Basin, Utah from Color Infrared Aerial Photography*, Salt Lake City, Utah, 1984.

146. Upper Colorado River Commission, *Forty-Seventh Annual Report of the Upper Colorado River Commission*, Salt Lake City, Utah, September 1995.

147. Utah Climate, 1992.

148. Utah Department of Agriculture, Agricultural Experiment Station, *Consumptive Use of Irrigated Crops in Utah*, Research Report 145, Utah State University, Logan, Utah, October 1994.

149. Utah Department of Agriculture, Agricultural Statistics Annual Report, Salt Lake City, 1994.

150. Utah Department of Agriculture, *1996 Utah Agriculture Statistics and Utah Department of Agriculture Annual Report*, Salt Lake City, Utah, 1996.

151. Utah Department of Natural Resources, *Utah Drought Response Plan*, Salt Lake City, Utah, 1990.

152. Utah Division of Parks and Recreation, *1992 Utah SCORP: Utah's State Comprehensive Outdoor Recreation Plan*, Salt Lake City, Utah, June 1993.

153. Utah Division of Water Quality, *Standards of Quality for Waters of the State*, Utah Administrative Code R317-2, Salt Lake City, Utah, February 16, 1994.

154. Utah Division of Water Resources, *Utah State Water Plan*, Salt Lake City, Utah, January 1990.

155. Utah Division of Water Resources, *Potential Damsites in the Uintah Study Area*, Salt Lake City, Utah, April 1996.

156. Utah Division of Water Resources, *Water-Related Land Use Inventories, Uintah Study Unit*, Salt Lake City, Utah, May 1994.

157. Utah Division of Water Resources for Uintah Water Conservancy District and Ute Indian Tribe, *White River Dam and Reservoir Project Summary Document*, Salt Lake City, Utah, March 1977.

158. Utah Division of Water Resources, in cooperation with Utah Water Research Laboratory, *Hydrologic Inventory of the Uintah Study Unit*, Logan, Utah, March 1970.

159. Utah Division of Water Rights, *Rules and Regulations Governing Dam Safety in Utah*, Salt Lake City, Utah, 1982.

160. Utah Geological Association, *Hydrocarbon and Mineral Resources of the Uinta Basin, Utah and Colorado*, Salt Lake City, Utah, 1992.

161. Utah Governor's Office of Planning and Budget, *State of Utah Population Projections for 1995*, Vernal, Utah, August 1994.

162. Utah Office of the State Planning Coordinator, *Energy 2000: The Impacts of Energy Development in Eastern Utah*, Office of Governor Scott M. Matheson, Salt Lake City, Utah, November 1980.

163. Utah State Legislature, *Resolution on Central Utah Water Project-General Session*, HCR No. 14, March 1993.

164. Utah Water Conservancy District, *Draft - Duchesne River Hydrology and Water Availability Study*, October 15, 1996.

165. Utah Water Conservation Advisory Board, *Recommendations for Water Conservation Standards and Regulations in Utah (Public Review Draft)*, August 1995.

166. *Utah Water Pollution Control Act, Title 26, Chapter 11, Utah Code Annotated, Amended*, Salt Lake City, Utah, 1953.

167. Utah Water Quality Board, *Utah Wastewater Disposal Regulations, Part 6 - Ground Water Quality Protection Regulations*, Salt Lake City, Utah, adopted May 26, 1989.

168. Utah Water Research Laboratory for the U. S. Department of Interior, Geological Survey and Utah Department of Natural Resources, *Consumptive Use of Municipal Water Supply*, Logan, Utah, August 1996.

169. Waltemeyer, S. D., *Selected Climatic Characteristics of the Southeastern Uinta Basin, Utah and Colorado*, No. 82-91, 1982.

170. Weir, J. E., Jr., *Geohydrology of the Area near WOSCO [Western Oil Shale Corp.] Exploratory Hole Number 1, Uintah County, Utah*, 27 p., 1970.

State Water Plan - Uintah Basin

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